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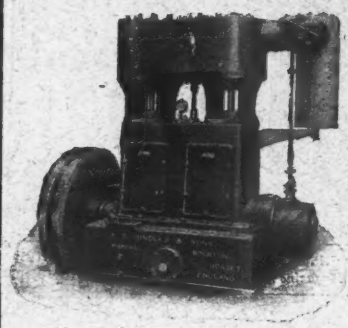

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THE

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TRADE ORGANISATION.

DURING the past two years a vast amount of attention has been devoted to the question of national industrial organisation. There have been luncheons and conferences, lectures and negotiations, all designed to further movements in that connection. How far have all these efforts been successful in bringing the industries of the country into one fully representative body armed with authority and information to enable it to speak on behalf of industry as a whole? There is a feeling that, notwithstanding all that has been done, there is still something wanting.

As we have ventured to suggest for a long time past, strong trade associations are necessary to which the Government can turn for information regarding particular trades, but we should like to feel that our negotiations and conferences gave better promise of an actual Parliament of Industry in which all our national industries had their seats occupied by duly accredited representatives of Capital, Labour, and Industry. It would be so much more satisfactory for the Government to be able to turn with confidence to a truly national and representative body when it needed guidance in regard to large industrial policy. We are sure that Mr. Neville Chamberlain must have thought so in the course of his National Service investigation and preparation. At present the Government is able in some cases to depend upon the co-operation of a number of specialised and more or less representative trade associations, but some of the industries have not one coherent body qualified to speak on their behalf, and only a comparatively few of the associations which are in existence are co-ordinated in their operations. The war has demonstrated the need for trade associations to foster and develop particular departments of industry, and as was shown in our pages at the time, Mr. Asquith last year gave Governmental approval to this aspect of the organisation idea. We may be pretty confident that the Lloyd George Government will not be less in favour of our industrial house being set in order along these lines, for between now and the end of the war, as well as in the years following, all sorts of questions will be bound to arise in connection with which it will be necessary for the State to consult those responsible for the conduct of our great industries, whether as capitalists or as workers.

The call for organisation of trades, or, more properly, industries, was voiced once more last week in a lecture at the London School of Economics. The audience was not one of manufacturers, so the treatment of the subject necessarily had to follow more or less general lines which to us and our readers would not be at all unfamiliar. One of the ways in which the lecturer (Mr. E. J. P. Benn) seems to us to differ from other speakers when dealing with this matter is in his discounting all efforts that have been made during the last two years. We confess to feeling a little disappointment that the comprehensive super-organisation of all great industries has not emerged by now, but we are not inclined to agree with him that "Chambers of Commerce, federations of industry, and other similar bodies . . . . live almost entirely upon politics," nor can we quite agree that "their existence depends upon the tariff agitation," though in some cases we know that it does do so. Yet we cannot

see why, even if they do so depend, they should have "no place in the serious study of the development of trade efficiency or the increase of national output." In other places at least one of the federated organisations (which was represented at Mr. Chamberlain's Birmingham meeting last Saturday) has been attacked because it is *not* outspokenly protectionist. We do not believe that either Mr. Benn on the one hand, or the daily Press on the other, assists the organisation movement by dragging in fiscal controversies. It seems to us that Mr. Benn wants us to start *de novo*, as though all the great industrial negotiations of the past two years were so much serious effort thrown away, and he would have us face the fiscal question as though there had been no war with Germany, in which connection we have no fears whatever that he will be able to carry the nation with him. Not only does it seem to us that Mr. Benn wants us to start *de novo* in regard to our organisation efforts, but he expresses views which might be more in keeping with a state of things which would exist if we were at the *beginning of industry* instead of having reached the advanced and complex industrial position in which we stand to-day. His desire is that every workman and workwoman should be a member of a trade union; that every manufacturer should be a member of a trade association; that from the trade unions and trade associations in a given industry there should be elected representatives to sit in a Trade Council; that from these Trade Councils there should be elected a National Trades Council with a member of the Government at its head, whose duty it would be to promote the trading interests of the country, and that in this way the Government should recognise and control both parties in industry. The Government must demand of the unions that they abandon their independent and irresponsible attitude, and it must demand of the masters' associations that they give up those elements which are contrary to the public interests.

The trade association idea is preferred to the trust or amalgamation tendency, because it would keep the little man in being. The little man is described as a "tremendous" asset in trade, for, somehow or other not explained, he is "essentially British." His only trouble as seen by Mr. Benn is that he *will* devote his energies to fighting other little men "instead of joining with them in an effort to fight the battles of the nation, and to improve himself and his industry." In passing, we may say that we were not aware that it was only the *little* man who fought his competitors, but we fully agree that "if we can get the advantages of amalgamation or united action without destroying the little man we shall be better off." How are we to proceed in order to reach this very desirable end when the "little men" have to meet in competition Teutonic trusts with anywhere between £10,000,000 and £15,000,000 capital? Here by a stroke of the pen we have it. Let us, he says, organise our little man, let us arrange his work for him, "force" him to specialise on some one little part of the trade in which he is engaged, then we shall "secure the advantages of economical production, which is the main asset of the trust or combine." Now this is essentially a matter for manufacturers, and for those who have built up our industries with individual enterprise and capital; it is certainly not a new one for discussion among electrical manufacturers. Would newcomers ever be admitted to an industry? If so, would they be told what they must manufacture? Could we call this freedom from restraint of trade or of industrial enterprise? We hardly know which idea we prefer—that of the trust or that of the trade association in which co-operation *cum* compulsion is the ruling principle. Can it be supposed that the latter is an attractive policy wherewith to induce every manufacturer to become a member of a trade organisation? To effect it would certainly call for a Government which was prepared to impose compulsion upon industry all round, and with an iron hand. How can it be effected otherwise in this very human world—except at a School of Economics? Its only chance of succeeding is through negotiation, and, if you will, "peaceful suasion" within the ranks of an industry itself. Mr. Benn's ideas may sound attractive enough at a homely gathering at the London School of Economics where there is a lecture but no following discussion: they may be applicable, too, in respect of bedsteads or of boots, but our concern is more with the electrical and engineering industries, and the possible application of those ideas thereto in this year of grace nineteen hundred and seventeen. When the lecturer refers to the iniquities of the "stupid competitive system" which forces every manufacturer to attempt to cover the whole of his trade, and thus waste half of his energies, we incline to the view that he over-states his case—unless he has boots and bedsteads in his mind. The application of the principle of co-operation is already at work in some trades, among them the electrical, and we believe it will grow spontaneously or by judicious fostering rather than by *forcing*.

We are sorry that the space at our disposal prevents us from following Mr. Benn through many other parts of his lecture. The whole discourse is a very interesting, though ambitious, one, for we agree with him that "trade is a very large subject, far too complex for any one mind to grasp properly;" "one can very easily become lost in detail." After all, the specialists in each trade must know their own problems best, wherever the State comes in to promote their organisation under its protection.

We confess to a little confusion arising in our minds as we consider some of the lecturer's remarks. For example, we cannot quite see what sewers and cemeteries have to do with "trade," at any rate, in the way he uses them. That they are essential, as trade is, for our well-being, goes without saying, but is it suggested that we now give less attention to trade than we do to local government because there are thousands of local authorities? If so, then surely he means that in the multitude of organisations there must be strength and wisdom! He says: "There are 28,678 local authorities in the United Kingdom to attend to sewers, cemeteries, street lights, and other such details. Surely trade is worth at least as much attention." But, surely, we have more than 28,678 factories, works, firms, associations, and organisations looking after trade!

We are entirely at one with Mr. Benn when he argues in favour of more enterprising and co-operative effort on the part of traders in the capturing of trade abroad; but this is an old story in the electrical and engineering world. "Every trade must present a united front to foreign competition," and the "small man" who cannot afford to cover the markets with business-getting men of the right type on his own account knows quite well that if he have the mind to do so he can secure his share in competition with the foreigner by acting in co-operative groups, whether consisting of half-a-dozen different sections of his particular industry or of half-a-dozen individual firms in his own particular section. It is partly because the Teutonic trusts have been so wealthy that they have been able to cover the world markets so efficiently with capable representatives, and have been able to secure the spoils. In some of the coming markets of the world they may repeat their performances if we are content to act in such matters individually as "small men," however much the latter may be "forced" to alter their lines of manufacture in the interests of economical production.

Dr. Heath, of the Advisory Council, in congratu-

lating Mr. Benn on the plainness with which he had expressed his opinions, told us that for the securing of Government grants for industrial research representative trade associations were essential, and that associations which desired to secure these grants would have to be representative of the employers, of the workers, and of men of science. It is along these lines, then, that we must proceed to develop and adapt our associations, though, of course, there are many other things besides research grants—important as these are—for which they exist.

British Electrical Exports and Imports during 1916.

READERS who are interested in trade statistics will view with interest the graphic summary of our electrical export and import business during the last few years, which we publish elsewhere in this issue. Attention may be drawn, amongst other things, to the gratifying improvement in export values during the past year, despite the many obvious difficulties of overseas trade; to the important position now occupied by France as a purchaser of British electrical goods; to the growth of Dutch lamp imports into this country, the value of such imports during the year having considerably exceeded £300,000; and to the growing activity of the Japanese electrical industry, as represented by the rising values of Japanese material imported into this country, and the competitive power which this portends in other more accessible directions.

Although the importation of American electrical goods continued on a large scale, comparable with German business before the war, yet there appears to be a tendency to a falling-off in values, which we hope may be due to other causes than merely official restrictions. On the whole, we have good reason to be proud of the result of our efforts during the year, which, in addition to rendering material assistance to allied and more nearly related countries at a critical time, have no doubt helped to augment the "silver bullets" which represent victory in the field.

The Rating of an Electric Lighting Station.

IN the recent case of the Clones Electric Lighting Co. *v.* Commissioner of Valuation, which was heard at Monaghan on January 18th, Judge Johnston, sitting as Recorder at Quarter Sessions, heard an appeal from the Commissioner of Valuation. The case related to the valuation of the Clones electric lighting undertaking, and his Honour, in his judgment, considers some points which are of general interest. As those who have been concerned with the law of rating are aware, the assessment depends upon what an individual known to lawyers as the "hypothetical tenant" would pay for the property as a going concern. In the case of a house, the hypothetical rent is comparatively easy to determine; but who can say off-hand, or even after much computation, what any individual might pay as rent for the property of an electric lighting company? The rateable value of the property of the company in question was recently fixed (for 1915) at £100. In 1914 it had been £25, and the company appealed.

The first question for decision was whether a 112-H.P. gas engine and a 40-H.P. oil engine should be included as part of the rateable property. In England, such machinery would be rateable on the principle laid down in the Tyne Boiler Case, but in Ireland the matter is virtually decided by statute, the Valuation Act, 1860, providing that "motive power . . . shall be valued with the buildings," but that "no machinery shall be taken into account other than that used for the production of motive power." Judge Johnston decided that the engines were rateable; but he also decided—and with his decision we venture respectfully to agree—that the accumulators, dynamos, switchboard, and belting, being mere tenant's fixtures, were not rateable.

Passing on to other questions, he held (applying certain well-known principles) that the rateable value must depend on revenue. It was contended on the part of the appellants that inasmuch as the year 1914 meant a loss to the company, that year should be taken into account when arriving at the profit. The learned judge, however, declined to accept this view, saying that the letting value of the hereditament as it stood was the figure to be ascertained. It was not for him to look back to previous years. He did, however, allow regard to be had to the meter readings of 1916, which made it plain that, as the career of the company was one of increasing prosperity, they were favoured by his having regard only to the revenue of 1915. In the event, he reduced the rateable value from £100 to £75, after pointing out that the "revenue" in contradistinction to the "constructional cost" method of valuation was the right one to adopt in the case of electric lighting companies. Incidentally, it may be mentioned that, in arriving at the gross profits, the appellants sought to be allowed to deduct the rent which they had to pay for the land on which the power station stood. But this was not permitted, because if they had redeemed the rent by an expenditure on capital account that would be treated, for rating purposes, as landlord's capital, and would not carry with it any allowance.

The Education of Engineers.

THE Committee appointed by the Manchester Association of Engineers in November, 1914, to consider this subject, recently issued a valuable report, which ought to be in the hands of all employers and educational authorities. Proposals are put forward to bring about closer co-operation between these parties, by the election of representatives of the former by the large technical societies, to form, with an equal number of technical representatives of the local educational authorities, an advisory body to deal with all questions (other than finance) arising in connection with the education of engineering apprentices. The Committee takes the view that in all cases the school or university training must be supplemented by adequate shop training, which cannot be given at a technical school, and must be continuous throughout a definite period. Too early specialisation is deprecated, 14 years being suggested as a suitable age at which to decide upon a boy's future vocation.

Referring particularly to engineering apprentices, the Committee recommends the raising of the minimum age for leaving school to 15 or 16 years, the attainment of a satisfactory standard of education before apprenticeship, and continuity in education by part-time attendance at school up to the age of 17; after attaining that age those who are capable of assimilating advanced technical training should be admitted to a day course (one day per week), the remainder being encouraged to attend evening classes. An important feature of the recommendations is that scholarships should be provided to enable deserving youths in the works, whose behaviour and progress are satisfactory, to obtain further education.

For brevity and lucidity the report is unexcelled, and the recommendations will, we believe, meet with the approval of the vast majority of those who have studied this important subject. The only uncertain element is the attitude of employers towards the proposal that apprentices shall spend two half-days a week at school, with wages, up to the age of 17; but some of our best firms are already working on similar lines, and we believe that the concession would be amply repaid within a short time. Hearty co-operation is again the key to the position.

SOME CONSIDERATIONS AFFECTING THE USE OF ELECTRICITY IN AGRICULTURE.

(*Continued from page* 64.)

A QUESTION which will naturally occur to any engineer who studies the broad question of agricultural electrical supply, is as to the possible scope of such business.

Unfortunately, detailed statistical information bearing on farm power does not appear to exist in this country, and in regard to this and other matters it is only possible to make certain deductions from published data.

In our issue of December 3rd, 1915,* we published a rough map of the agricultural portions of England, showing the existing supply undertakings which might be utilised in initial attempts to supply the farmers in the area shown. About 160 such generating stations were shown as being in touch with agricultural country; for electrical supply purposes each of these stations can be assumed—as a basis of estimate—to deal with an area 10 miles in diameter, equal to 78½ sq. miles, or, deducting 1½ sq. miles for the built-up area of the town, which is usually not a large one, there is left 77 sq. miles of agricultural country per station. According to the 1906 Census of Production, the number of holdings or farms per 1,000 acres varies from 12 to 14 as between the Eastern and Western English agricultural areas, representing, roughly, 70 to 80 acres per farm, a figure which is probably a fair average, bearing in mind that the small holdings are more numerous in the vicinity of towns. On this basis it will be seen that each of the assumed station areas would contain from 600 to 700 potential farm consumers, in addition to village and private house consumers, possible industrial users and public lighting. Averaged over 160 stations, this represents, roughly, 100,000 potential farm consumers for a small portion only of the country, and, if we can judge by published data regarding farm business here and abroad, each farm would, on the average, be worth at least 30 lamps and 5 H.P. of power to the electric supplier, representing a total of three million lamps and half a million H.P. in the initial stages for the 160 undertakings referred to.

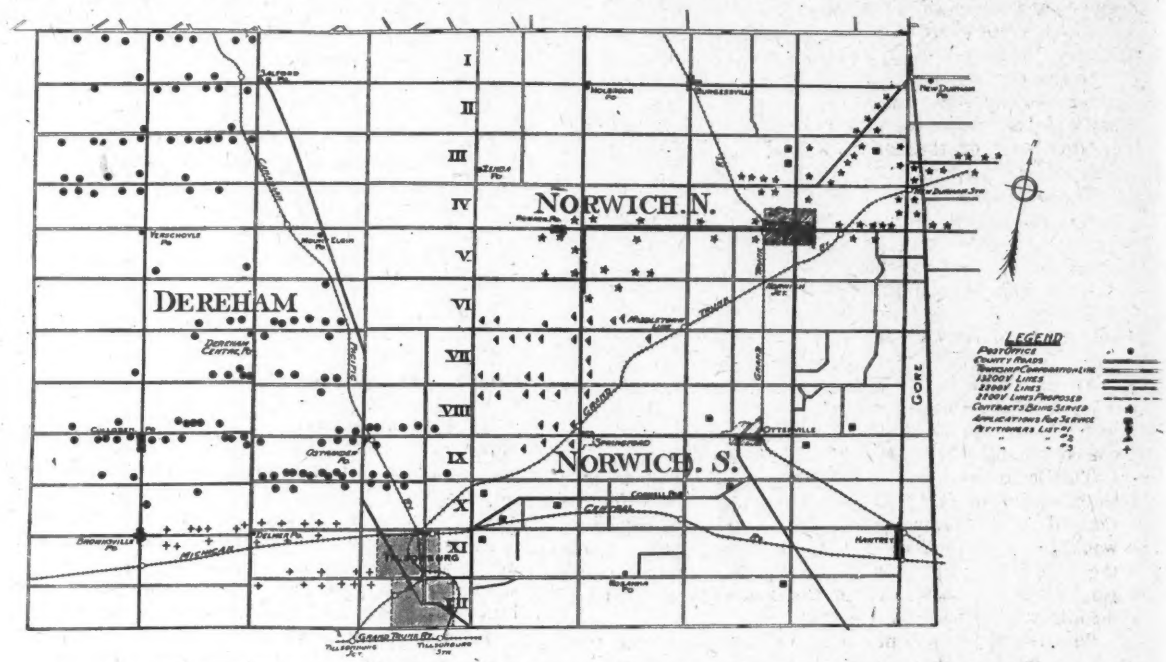
Published data in regard to power actually used on farms are very meagre and, no doubt, misleading at the present time.

For instance, in 1906 it would appear that for the whole of Great Britain some 213,000 H.P. of steam, gas, oil, and other engines was employed, steam, the most wasteful form of power on a farm, accounting for 106,000 H.P., or nearly one-half. The figures do not include temporarily hired engines, which would, no doubt, have greatly increased the total, and it is obvious that in the intervening, and particularly the last two, years a great increase must have occurred in the total.

An interesting feature of the 1906 figures is that only ·4 H.P. was used, on the average, per holding (of 1 acre and above), while in the case of the holdings of 1 to 50-acre size, an average of only ·06 H.P. was used per holding.

It cannot be contended that these figures are any guide to the farmers' possible power requirements, if electrical power were available, as will be gathered from Mr. Kerr's paper* on the subject last year; if anything, they are significant of the backward state of the agricultural industry.

In the discussion following the reading of that paper, it was pointed out that Hereford farm consumers paid an average of £25 each for electricity, and on this basis some 2½ millions per annum of additional revenue from farms alone is awaiting the efforts of supply authorities in the 160 central-station areas referred to.



MAP SHOWING PROGRESS IN ELECTRIC SUPPLY TO FARMS IN PART OF OXFORD COUNTY, ONTARIO.

As touching on the traction problem and the possibilities of employing electric tractors, vehicles, and ploughs, it may be noted that there were in 1906 about a million and a-half horses on farms in Great Britain, at least half of which were, no doubt, used for traction purposes.

The work carried out by Mr. Kerr at Hereford demonstrates the feasibility of supplying farms in the vicinity of a country town, but it leaves us to surmise as to the position which might arise if the farm load greatly preponderated over that of the town.

No reliable data, so far as we know, has appeared in reference to a considerable rural supply system, which is strictly applicable to English conditions, and an investigation of the probable load characteristics, and other features of such a system, would be of considerable assistance in connection with the movement for agricultural supply.

An American writer† who recently investigated this aspect of the question as regards the Pacific North-Western area of the U.S., pointed out that in the particular undertaking investigated, 37 per cent. of the population served was outside the city limits; this 37 per cent. furnished 38 per cent. of the company's revenue, but required 51 per cent. of the operating expense and gave only 10 per cent. of

* "Electricity in Agriculture; its National Aspects."

* "Application of Electricity to Agricultural Purposes"; I.M.E.A. *Proceedings*, 1916.

† N.E.L.A. Paper on "Rural Transmission Lines," by A. S. Hall.

the operating revenue and about one-third of 1 per cent. of the net operating income. However, it appears that though each class of business is credited with its own operating and financial expense, the rural business is catered for by a cut rate, because it is argued that were it not for the 37 per cent. of rural business the city business would show a less net revenue than it now does, and the rates on the city business would have to be materially increased. It is further argued that such rural business might be justified even if carried on at an apparent loss. The limiting factor is the quantity of rural business which a given city business can profitably support. In this particular case the rural business gave 38 per cent. of the gross revenue, but required 47 per cent. of the total investment, or 9 per cent. more than its share, and incurred additional financial charges to that extent, and the writer in question addresses himself to the problem of overcoming this handicap, believing that the solution will be found in the adoption of new and cheaper standards of construction for such work; wider limits of variation of supply voltage; specially adapted rural rates; and the joint use of pole lines by electric supply and telephone lines—a joint service being practicable in cases where a single service is not on the ground of cost.

In this country, so far as can be judged from experience in farm supply, such consumers would find it profitable to pay a higher rate for energy than the usual town rate, which is often based on the competition of a cheap gas supply which does not extend into the farm areas.

The experience of the Ontario Hydro-Electric Commission in rural supply is important. There are approximately 1,000 rural services on the Ontario system, and of these about 60 per cent. are farms. In the Toronto suburban district there are 200 rural services; in Grantham township, a fruit-growing district, there are 100 rural services; and in North Norwich township, a dairy district, there are over a 100 such services connected and applied for.

Probably due to labour shortage, the Commission had many more inquiries in 1916 for farm power than in previous years, and amongst the large petitions received was one containing 476 names from a particular district.

The Commission will give a service where there are only three consumers per mile; the usual procedure is for the Council of the township to present a petition, signed by would-be consumers, and accompanied by a map showing the location of their farms, to the Commission, which prepares an estimate of cost of lines, and supply, and submits a definite tariff to the Council.

The tariff is then submitted to a meeting of the petitioners, who, if they accept it, must sign the contracts before any construction work is commenced.

The contracts are between consumer and township, and, assuming that sufficient consumers have been secured to warrant the building of a line, the township then contracts with the Commission for a supply of energy.

All primary lines are constructed by the Commission at its own cost, and all secondary construction, including transformers, lines, services of not more than 120 ft. from the main line, meters and cost of installing them, are paid for by the township, whose share of the cost is covered by a debenture issue. The township may operate its own system, but the cheaper way is for the supply station authority to undertake the work, in which case it would collect all consumers' accounts, meet operating expenses, pay to the Commission the amount due for power used, for the annual fixed charges on the township's debentures, and similar charges on the cost of the primary lines.

It should be noted that under this arrangement the farm supply business appears to be on a self-supporting basis, the tariff being based on the cost*, which the Hydro-Electric Commission's extensive experience in this connection should enable it to estimate with considerable accuracy. Actually the rural rate consists of a "service charge" of $3 per month for three consumers per mile; $2·50 for four consumers; or $2 for five consumers, plus a KW.-hour rate for all consumption up to the first 60 hours' use per month of the contract amount, and a charge of one-half this rate for all remaining consumption during the month, the secondary KW.-hour rate being based on the cost of power in the district.

Many consumers wish to install a 5-H.P. motor, but generally use only a 2-H.P. demand, and to meet such cases a consumer with a 2-H.P. contract is allowed to install and operate a 5-H.P. motor with the understanding that the township can install a special meter to indicate excess demand, and charge for it at 1½ times the initial KW.-hour rate.

The following is the approximate cost of farm construction work on the Commission's system:—

Assuming that a three-phase service is carried 600 ft. from the pole-line on the road to the farmer's barn, where the transformers would be located to be near the power site, and that a single-phase lighting service were carried back 300 ft. to the house, the cost would be, roughly, $46. Interior concealed wiring would cost, per outlet (knob and tube), $2-2·5; conduit, $3·5-5; and open wiring, 90 c.-$1·5. The wiring for a house and barn would cost:—

House.—10 lights on 2 switches, at $2·5 per outlet ...	$30·0
Barn.—6 lights and 3 switches, at $4·5 per outlet ...	40·5
Outside light for yard	3·0
Service entrance	5·0
17 lamps, at 25 c. each	4·25
Lines into premises	46·0
Total	$128·75

The above figures are approximate, and only of interest as showing what the Commission considers should be the cost of this class of work in Ontario.

It should be noted that the Ontario Power Commission Act, 1911, was introduced to facilitate the distribution of electrical energy in rural districts, and the Fifth Annual Report of the Hydro-Electric Power Commission (for 1912) mentions that the response to this in the form of inquiries and petitions was so great, that the Commission carried out a series of demonstrations at exhibitions, fairs, farms, &c., in accessible districts, with a view to educating the farmers.

In addition, several demonstration farms were completely equipped with electric power and lighting. One of the important factors behind this instructional campaign was the desire to improve the load characteristics of this class of business by inducing farmers to so rearrange their work as to improve the electrical load factor, and thus facilitate cheap supply. The absence of a steady flexible supply of power resulted in the farmer reserving all the heavy operations until such time as a steam engine could be hired to do this work in the shortest possible time—a system which can obviously be modified if electric power is continuously available.

(To be continued.)

* We do not know on what basis the power cost is determined in individual cases, but it is obvious that a "cut" rate could be offered, if thought desirable, for development purposes.—EDS. E.R.

THE FARADAY SOCIETY.

AN ELECTRIC FURNACE FOR TESTING FIREBRICKS.

AT the December meeting of the Faraday Society, Mr. B. A. GRIFFITHS and Mr. EDGAR A. GRIFFITHS, of the National Physical Laboratory, exhibited and described a carbon tube furnace which they have recently been using for carrying out a series of tests on the softening points of refractories, and their compressive strengths at furnace temperatures exceeding 1,800 deg. C., properties obviously of the greatest importance in considering the practical value of a new refractory.

A sectional view of the furnace is shown in fig. 1. The ¼-in. carbon tube C is of 2 in. outside diameter, and is 11 in. long. A ¼-in. slot extends down almost its entire length, to permit of observations of the heated specimen. The tube is encased in a sheet iron casing A, 12 in. diameter, the ends of which are closed with asbestos slate board B B. The thermal insulator consists of crude zirconia powder—an excellent insulator—surrounded by a 3-in. layer of magnesia-asbestos lagging.

A most important feature of a carbon tube furnace is the construction of the electrodes, for any heating caused by the passage of large currents across the metal-carbon junction is fatal. Fig. 2 shows how the electrodes are formed in the present furnace. A copper tube, through which the water for cooling passes, is bent into a zigzag form and white bearing metal cast around it, the mould being formed of strip iron with the carbon tube as core. In this way a perfect fit between metal and carbon is ensured, and with a current

of 400 amperes the drop of potential across the contact was barely detectable.

Another type of electrode designed for a large 5½-in. crucible furnace is also of sufficient interest to describe here. This is shown in fig. 3. LL are graphite blocks bored to the diameter of the furnace tube. The copper leads M are hollow, and water-cooled. A further contact with the graphite blocks is through the flexible conductor O.

To preserve a neutral atmosphere a stream of nitrogen is passed through the tube, otherwise the carbon is rapidly

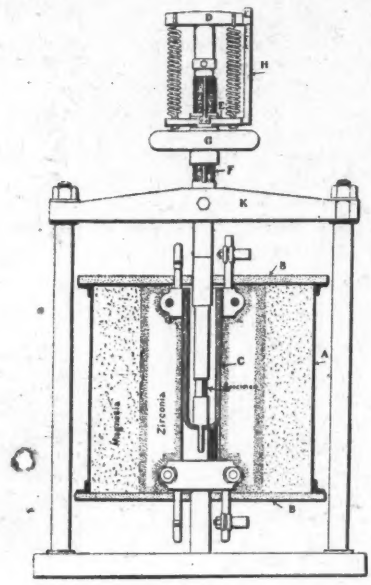


FIG. 1.

oxidised. Up to 1,700 deg. C. the furnace is free from volatile carbon compounds. It is of interest to note that the atmosphere in the tube is highly ionised; in fact, currents of several amperes will pass between insulated electrodes having only a few volts potential difference between them. The current is accompanied by the transport of material particles, probably molecular aggregates.

Pressure is applied to the specimens under test, which are small cylinders of the refractory material about ⅝ in. diameter and 1 in. long, by means of the plunger arrangement above the furnace, the action of which will be clear from fig. 1. The magnitude of the pressure is read off on the scale H. In the furnace shown, pressures up to 150 lb. per square inch could be applied. The specimen is supported in the furnace on a carbon rod, from which it may be separated

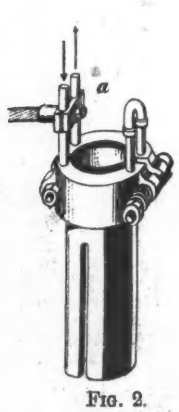


FIG. 2.

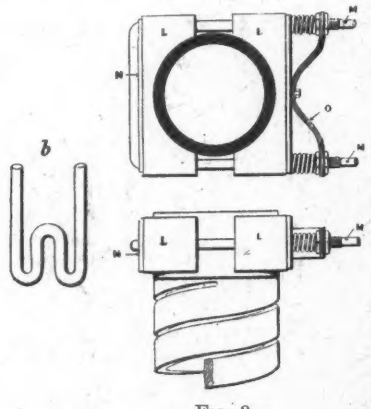


FIG. 3.

if contamination is feared, and a similar rod on top transmits the pressure. Usually three test pieces were taken from a brick, and the results only accepted if concordant. A test took about two and a half hours with a 10 deg. C. increase of temperature per minute.

Temperatures are measured in this furnace with an optical pyrometer, which sights the specimen through the slot in the furnace tube. Observations are effected by comparison with the field of illumination due to an electric lamp, the instrument being directly calibrated by comparison with a thermocouple under "black-body" conditions. It is possible to attain a temperature of 3,000 deg. C. with the furnace for short periods, but all commercial refractory bricks soften under loads below 1,700 deg.

The tests that have so far been made with the furnace cannot be published at present, but it may be stated that a magnesite brick normally breaks down at 1,500 deg. C. under a pressure of about 30 lb. per sq. in. The authors have placed in the hands of makers and users of refractories an instrument of considerable value.

A METHOD OF UNITING OPTICAL GLASS BY HEAT.

Mr. R. G. PARKER and Mr. A. J. DALLADAY described a very ingenious method they have devised for uniting together glass surfaces polished plane, or to the same curvature, to a high degree of accuracy. The existing method, that of cementing, has obvious disadvantages, both mechanically and optically, and to do away with the necessity of cement is, as Dr. Rosenheim characterised it, a remarkable achievement. The method, once it is known, is the quintessence of simplicity. The finished surfaces are merely placed together and subjected to carefully-controlled heating, some 80-90 deg. C. below the annealing temperature, when, under slight pressure, complete union takes place, the two pieces become absolutely one, and it is impossible to separate them along the surface of juncture. The possibility of the process probably arises from the fact that glass under slow stresses acts as a highly-viscous liquid, which becomes fairly mobile as the temperature is raised, even very far below the melting range.

The operation is carried out in a platinum-wound electric oval tube furnace, 3½ in. by 2½ in. by 14 in. long, fitted with double silica windows at each end. Two resistances permit of a very close control of temperature, down to ¼ deg. C. per minute, which is measured on a Callendar recorder. An arrangement by which polarised light can be passed through the furnace, so as to examine the effect on the glass or silica under operation of unequal heating, completes the apparatus. The method has been used successfully to construct such

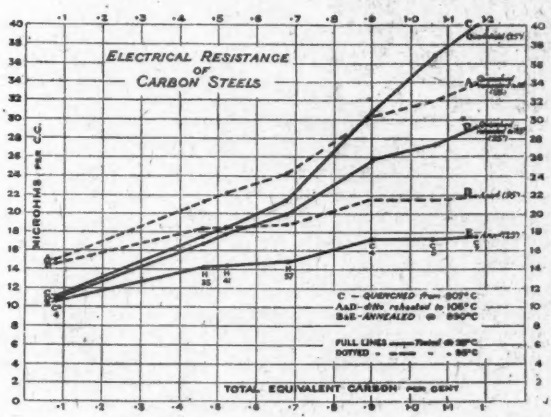


FIG. 4.

apparatus as the cell for a Rayleigh interference refractometer or a polarimeter tube. Up to the present it has, unfortunately, not been found possible to unite two different kinds of glasses, such as the flint and crown used in object glasses, owing to their differences in annealing temperature. Fused silica can, however, be welded by this method.

THE RESISTANCE OF IRON AND ITS CHEMICAL COMPOSITION.

Prof. E. D. CAMPBELL, of the University of Michigan, presented a paper, which was read by Sir Robert Hadfield, entitled "Do Equiatomic Solutions in Iron Possess Equal Resistances?" The conception of steel as a solid solution long ago suggested a relationship between its chemical composition and its resistance, and Benedicks, in 1902, put forward his well-known rule that equiatomic solid solutions in iron possess equal resistances. This relation was based on certain assumptions, which need not detain us now, that the experimental work of Arnold has shown to be untenable, and the object of the experiments described by Prof. Campbell was to see whether it might not be possible to suggest a more satisfactory hypothesis to explain the relation between carbon-concentration and resistance of heat-treated steels. The experiments were made on seven steels of various compositions in both the hardened and annealed states, the heat treatment being carried out in a small electrically-heated furnace on bars 6 mm. square and 15 cm. long. The specific resistances were measured at 25 deg. C. and at 95 deg. C., maintained by means of an oil bath, and were determined by measuring the fall of potential between knife edges clamped to the bar 10 cm. apart, a constant current flowing through the bar. The experimental results are embodied in the accompanying curves (fig. 4). It is at once obvious that different amounts of influence are produced in the specific resistance by equiatomic concentrations of carbon. On taking into consideration, however, the amount of iron carbide present, Prof. Campbell concludes that what determines the deviation of resistance from that of pure iron is the *molecular* concentration of the *carbides* in solid solution, and not the *atomic* concentration of the *carbon*, and he puts forward this hypo-

thesis for consideration and experimental confirmation. One striking point to be noted in these results is the almost constant value of the absolute increase in specific resistance with increased temperature, at which the specific resistance is measured, this increase differing very slightly from that of pure iron. These results would indicate that this increase in specific resistance with increased temperature is wholly due to the increase in specific resistance of the solvent, while that component of the total specific resistance due to the solutes in solid solution is very slightly, if at all, affected by the temperature at which the specific measurements are made.

The following papers were also read:—"Grain Growth in Deformed and Annealed Low-carbon Steel," sent in by Mr. RALPH H. SHERRY, of Detroit, who explains in it the conditions under which this undesirable grain growth occurs; and "The Effect of Pressure on the Equilibrium Constant of a Reaction in a Dilute Solution," presented by Prof. W. C. MCCULLAGH LEWIS, of the University of Liverpool. This paper indicates a simple mode of deducing the effect of external pressure on the equilibrium constant of a reaction in dilute solution.

It was announced that general discussion on the following subjects were in course of arrangement:—"The Training and Work of the Chemical Engineer," "Osmotic Pressure," and "The Physical Chemistry of the Setting of Cements and Plasters." The first of these will be held in February, and will be opened by Sir George Beilby, F.R.S.

PRINCIPLES INVOLVED IN COMPUTING THE DEPRECIATION OF PLANT.

BY F. GILL AND W. W. COOK, MEMBERS I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

(*Concluded from page* 83.)

VALUE OF PLANT IN PLACE AT ANY TIME.

The engineer controlling a system must be able not only to know the annual charges on each kind of plant, but also to estimate the value remaining in the plant at any time.

In considering extensions of plant, or the adoption of improved plant, it frequently happens that the question arises whether it is economical to take out certain plant still performing satisfactorily the service it is adapted to, and replace it by new plant of a more economical nature. If the existing plant is taken out, there will be a wastage of its then value in place, plus the cost of taking it out and less the amount received for the recovered materials, the net result of this being a present loss when the change is made. Against this loss there is to be set any economy in annual charges that may be gained by the new plant during the period which would have remained of the displaced plant's life. Further, since the wastage must be incurred when the change is made, while the prospective savings are in the future, the two sums must be brought to a common time for comparison; in fact, the problem is to find out if it is worth while to incur a present loss to achieve a future gain.

Unless the new plant will thus pay for the wastage, or unless there are compelling reasons which require the change irrespective of economy, the change should not be made.

If the first cost and the annual charges have been rightly estimated, the diminution in value is the amount which should be in the renewals fund, for that was the very purpose of the fund. That is, the first cost less the amount which should be in the fund is the measure of the remaining value.

One easy way to test the equity of the value in place produced by the alternative methods used in treating depreciation is to examine how each would result if an undertaking passed successively to several owners, on the basis of the remaining value being the first cost less the amount which should be in the renewals fund.

In this case, as already shown, the life concerned is not the economic life, but the physical life, so that in calculating the following tables we must take the physical life of 25 years, and the residual value, at the end of life, at £2.

Assume that an original owner whose conditions are set out in Table II (5 per cent. sinking fund), to whom the user of the plant pays £7.05 per annum, sells at the end of the eighth year on the basis of this table. He will then sell for £100 less £19.61 (the amount in the fund), = £80.39.

This second owner's conditions will then be: Capital £80.39, remaining life 17 years, residual value £2, other conditions as before, and the table shows these figures for the next eight years.

If the second owner transfers to a third owner at the end of the 16th year, on the same basis, he will then sell for £80.39 less £28.97 = £51.42.

The third owner's conditions will then be: Capital £51.42, remaining life nine years, residual value £2, other conditions as before, and the financial result is shown in the table.

If the third owner transfers to a fourth at the end of the 24th year, on the same basis, he will sell for £51.42 less £42.8 = £8.62.

This last owner's conditions will then be: Capital £8.62, remaining life one year, residual value £2, other conditions as before, and the table shows his position.

This last owner finds £2 from sale of materials and £6.62 from his renewals, and thus gets back the money he had invested.

TABLE II (ABBREVIATED).—VALUE OF PLANT IN PLACE.

Sinking-Fund Method.

A End of year In different ownerships.	A End of year In plant's life.	B Capital.	C Return on capital 5 % p.a.	D Renewals fund.	E Total C + D.	G Total in renewals fund.	H Value of plant, in place, B − G.	L Per cent. return on capital.
First owner.		£	£	£	£	£	£	
1	1	100·00	5·00	2·05	7·05	2·05	97·95	5
8	8	100·00	5·00	2·05	7·05	19·61	80·39	5
Second owner.								
1	9	80·39	4·02	3·03	7·05	3·03	77·36	5
8	16	80·39	4·02	3·03	7·05	28·97	51·42	5
Third owner.								
1	17	51·42	2·57	4·48	7·05	4·48	46·94	5
8	24	51·42	2·57	4·48	7·05	42·80	8·62	5
Fourth owner.								
1	25	8·62	0·43	6·62	7·05	6·62	2·00	5

TABLE III (ABBREVIATED).—VALUE OF PLANT IN PLACE.

Straight-Line Method.

A End of year In different ownerships.	A End of year In plant's life.	B Capital.	C Return on capital 5% p.a.	D Renewals fund.	E Total C + D.	F Balance to equalise 1st owner's annual charge of £8·92 p.a.	G Total in renewals fund.	H Value of plant in place, B − G.	J Interest on fund.	K Total return C+F+J.	L Per cent. return on capital.	M Average per cent. return on capital.
First owner.		£	£	£	£	£	£	£	£	£		
1	1	100·00	5·00	3·92	8·92	—	3·92	96·08	—	5·00	5·00	5·69
8	8	100·00	5·00	3·92	8·92	—	31·36	68·64	1·37	6·37	6·37	
Second owner.												
1	9	68·64	3·43	3·92	7·35	1·57	3·92	64·72	—	5·00	7·28	8·28
8	16	68·64	3·43	3·92	7·35	1·57	31·36	37·28	1·37	6·37	9·28	
Third owner.												
1	17	37·28	1·86	3·92	5·78	3·14	3·92	33·36	—	5·00	13·41	15·26
8	24	37·28	1·86	3·92	5·78	3·14	31·36	5·92	1·37	6·37	17·09	
Fourth owner.												
1	25	5·92	0·30	3·92	4·22	4·70	3·92	2·00	—	5·00	84·46	84·46

It is true that the portion of the annual charge allocated in this example to renewals becomes larger each year, being for the case under consideration, £2.05, £3.03, £4.48, and £6.62; but that is only one part of the transaction, and the increase is exactly counterbalanced by the reduction of the charge in respect of return on capital, in this case, £5, £4.02, £2.57, and £0.43. It will be observed that each successive owner has taken over the plant at what it would have stood at, had part of the capital been paid back each year on the annuity method.

Thus each successive owner has had the same plant, the same annual charge, and has got back all his capital at the end of his term.

Now contrast what happens under the straight-line law, the annual rental remaining constant at the amount fixed by the first year's annual charge. The figures used are shown in Table III.

The first owner's conditions are: First cost £100, life 25 years, residual value £2. He charges the plant with £8.92 per annum, and has the plant for eight years. During that time the money he receives, together with the interest earned by the renewals fund, which is not credited to its source, *i.e.*, the plant account, is sufficient to enable him to pay a return on his capital increasing from 5 to 6.37 per cent.

He then sells on the basis of this table at £100 less £31.36 = £68.64, and thus, with what is in his renewals funds, his capital is repaid.

The second owner's conditions are: First cost £68.64, residual value £2, remaining life 17 years, and the table shows the figures for the next eight years.

Here it is seen that the annual charges for the second owner consisting of the Return, column C, plus the Renewals, column D, fall short of the total for the original owner by £1.57, and this is available with the interest earned by the fund to give a total return on the capital increasing from 7.28 per cent. per annum in the ninth year to £9.28 per cent. per annum in the 16th year.

If the second owner transfers to a third at the end of the 16th year, he will sell for £37.28 (£68.64 − £31.36), and the conditions for this owner will be: First cost £37.28, residual value £2, remaining life nine years, and the result is shown in the table.

The balance here, column E, is greater than before, and the total return on the capital increases from 13.41 per cent. to 17.09 per cent. per annum.

If the third owner transfers to a fourth at the end of the 24th year, he will sell for £5.92 (= £37.28 − £31.36), and the last owner's conditions will be: First cost £5.92, residual value £2, remaining life one year, and his position is shown in the table.

This last owner gets £2 for the residual value, which with £3.92 in the renewals fund repays his capital, and the total return on his capital is 84.64 per cent. per annum.

Thus each successive owner has had the same plant, and has got back all the capital invested, but each successive owner has received a higher percentage return on the capital invested than any of the previous owners.

It may be argued that the amount of profit an owner can make has nothing to do with the value of the plant, and this is true. In the above cases the relative profits under the same conditions have merely been used to test whether the price at which the plant is valued seems a fair one or not.

When one finds that, on the one hand, when interest is brought into the transaction, there is absolute equality as between various years or various owners, and, on the other hand, when interest is not brought in, the successive year or successive owner is always progressively favoured, one has good ground for the conclusion that all is not right with the method of valuation which neglects interest on the renewals fund payments.

Equated Lives for Plant.

In treating a case in which there are various lives, it does not appear to be well known that the average life obtained in the usual manner of getting a weighted average is an erroneous figure to use in calculations for redemption of money. The late Mr. Robert Hammond referred to this in his paper on "Depreciation."

If we take a plant consisting of three classes of articles having different first costs and lives as shown below, we find that the average life is seven years, obtained as follows:—

	Amount. £	Life in years.	£ × years.
Class A	300	10	3,000
Class B	200	5	1,000
Class C	100	2	200
	600		4,200

Total average life 4,200/600 = 7 years.

But in the complete cycle of 10 years the money actually involved will be:—

	£	£
Class A, one renewal	= 300 × 1	= 300
Class B, two renewals	= 200 × 2	= 400
Class C, five renewals	= 100 × 5	= 500
		1,200

and therefore the figures should be, if interest be not added to the fund:—

	Amount. £	Life in years.	£ × years.
Class A	300	10	3,000
Class B	400	5	2,000
Class C	500	2	1,000
	1,200		6,000

Equated life = 6,000/1,200 = 5 years.

One usual way of calculating this equated life, *i.e.*, without interest, is to divide the first cost by the sum of the annual instalments.

If, on the other hand, interest (say 5 per cent. per annum) is added to the renewals fund, the calculation will give 4.95 years as the equated life.

If an average life of seven years is taken for calculating the provision, the actual deficit will be £1,200 − 857 = £343 in the 10 years.

From this example it will be seen that there is a great danger if the difference between average and equated lives is not appreciated. The equated life is always shorter than the average life. Provision for a complex plant can only be made either by providing separately for each part and summating the annual payments, or by using the correct equated life and treating the plant as a whole.

When, however, a sub-division of plant having the same general characteristics is considered, the average lives or ages may safely be used.

In some cases the life of plant is limited by the units of work performed rather than by time. One example of this is a tool such as a lathe or press; another is a locomotive. Such things do not wear out by the passage of time, but by the work which is done by them, and it would be wrong to estimate the life of such a thing merely in years irrespective of work.

The question arises, how the proper charge per unit of work is to be arrived at, since in some cases there must be found the correct amount to be charged to each job for the use of a tool or machine.

In such a case, time, *i.e.*, the physical and economic lives, must be brought into the calculation, and one is bound to estimate a period during which the units of work will be performed in order not to ignore the fact that the payment for depreciation is made in advance of the money being actually required, and therefore interest must accrue.

Constant Maintenance Cost.

It was assumed above that the maintenance cost would be constant throughout the life of the plant, and it is necessary to return to this question.

The renewal of each part, as it is required in its turn, is provided for by the fund established on the basis of the equated physical life. The cost of maintenance is the cost of looking after the plant, keeping it in running order, repairs, keeping records and inspections, but not of making renewals.

Sometimes in practice it is found more convenient to charge small renewals to maintenance rather than to renewals account, but that convenience does not affect the question of fact.

We believe that constant maintenance cost, if full provision is made for renewals, is a tenable assumption.

In the case of telephone plant, careful investigation failed altogether to detect any increase in the cost of maintenance with advancing age, and so far we know of no data showing increasing cost apart from renewals.

Some advocates of the straight-line method say that the interest on the depreciation fund is required to offset this alleged increasing charge.

If there are cases of maintenance cost increasing with age, this increasing cost must, of course, be met, and any such cases will doubtless have well determined cost data, but the provision should be made directly, and not indirectly. It would be curious indeed if on all classes of plant the increasing cost of maintenance were just the amount provided by interest at varying rates, compounded over various periods.

Assessment of Profits.

The amount to be charged to depreciation, or, as we prefer to put it, to renewals fund and to improvements fund, before assessing the profits of an undertaking, is the total amount indicated by the portion of the annual charges allotted to those costs. The correctness of the annual charges has already been discussed, and when these have been settled, then the charge against the year's income for renewals and improvements must follow in principle that settlement, subject to any alteration of fact which later knowledge may have brought to light. But this does not permit of any change in the method.

If the sinking fund method is correct for the annual charges, it must also be correct for the year's accounts; otherwise, the annual charges are not true, and if they are not true, the primary object of ascertaining the annual charges—to select plant wisely—is vitiated.

The accountant cannot logically at this stage question the correctness of the charge; he may honour the bill or not, may put away more or less than the correct sum as given by the annual charges, but this sum remains the true measure of the year's debit against the undertaking.

RESERVES INVESTED IN THE BUSINESS.

Up to the present one assumption has been that the capital account was closed and, therefore, the reserve funds could only be lent outside. But for many purposes it is more convenient to invest these reserves in the business itself rather than to lend them outside and raise fresh capital for the extension of the business. There is no difference in principle whether the reserve be lent outside or invested in the business; in either case the money must earn interest, and the interest must be credited to its real source.

CONCLUSIONS.

There is only one common method for the financier, the accountant, and the engineer. This common method is best studied in the annual charges for plant, determined in advance of construction.

To determine the amount in the annual charges for depreciation it is necessary to estimate the first cost, residual values, and the physical and economic lives of the various classes of plant. It is also necessary to fix the treatment of the capital account and to estimate the charge for return on capital.

The interest to be earned by the reserve funds must be credited to its source.

The reserves are preferably handled by means of two funds, as follows:—

(*a*) A renewals fund for providing the necessary money at the end of the physical life, that is, the end of the period during which the plant will give its service satisfactorily under all conditions *outside* the owner's control.

(*b*) An improvements fund for providing sufficient additional money to enable the plant to be taken out of commission for reasons *within* the owner's control, and while it is still giving its service satisfactorily.

The calculation of the amounts to be contributed to these two funds must include the interest which should be earned by the money before it is required at the end of the life.

The amount, calculated as above, which should be in the renewals fund gives the correct diminution in value, when considering the value to the owner, of the plant in place and working, at any period in its history.

The amounts, calculated as above, which should annually be put to the two funds, renewals and improvements, determine the correct depreciation charge against the undertaking for the purpose of assessing profits, fixing rates, and, under certain conditions, assessing the value of an undertaking as a going concern.

The sinking-fund method fulfils all the requirements.

The straight-line method does not.

All estimates, such as first cost, physical and economic lives, and interest earned by funds, will require revision from time to time either as a result of experience or of changes in conditions.

DISCUSSION IN YORKSHIRE.

THE paper was read by Mr. COOK and discussed at a meeting of the YORKSHIRE SECTION OF THE I.E.E. on Wednesday, January 10th.

Mr. STANSFIELD (Yorkshire Electric Power Co.) said he feared that the authors had not taken into account the difficulties which the accountant must meet and overcome, and those which had to be encountered and overcome by the business-man, who had to make the undertaking a success. Accountants had particular opportunities of observing the methods of those in authority, and appreciating the reasons for the somewhat rough-and-ready methods adopted. In considering depreciation, they must remember that the primary necessity was to obtain business, and that they were forced to deal with depreciation according to the year's working. Directors, shareholders, and councillors did not concern themselves very much with rates and methods of depreciation, and engineers and accountants alike had in the end to adopt methods as little complicated as possible. Competition had to be faced. The maintenance method, the first one to be thrown overboard by the authors, was the policy pursued by railway companies with enormous capital and plant, and though this was, perhaps, not theoretically sound, there must be something in it, because the railway companies had not gone into liquidation. He agreed with the authors' objection to the reducing method, because during the earlier years the plant would not earn so much as in later years, and profits would not be such as to provide a sufficient surplus for depreciation. In regard to the straight-line method, it must be assumed that its advocates had thought it out, even if the advantages of the system did not seem to be capable of demonstration. It appeared to him that the sinking-fund method required very elaborate book-keeping. If it was to be consistently adhered to, the life of each important piece of plant would have to be dealt with separately. That was an important point when the supreme powers came to have their say in the matter. He agreed with the authors that the objection to the sinking-fund method on the ground that it must be unfair either to the buyer or the seller was absurd. Undertakings were not run for the purpose of being sold. It could safely be employed on the repayment of money either by equated or regular payments. Then there was a time period within which it must be repaid. It could be used for life assurance, because the period of life could be averaged, but it was a very different matter to deal with plants whose life could only be estimated, and where they could only depreciate in accordance with the amount of profit which had been made.

Mr. WHITTAKER (Borough Treasurer of Wakefield) said he had been struck with the fact that the authors appeared to regard maintenance as a standing charge; however the plant might be depreciated in the future, the same amount of maintenance was to be charged to revenue each year. He had found that the maintenance charges on the Halifax plant had increased year by year, and he had, to a large extent, adopted the straight-line method. The paper had opened his eyes in the matter of the improvements fund. He had not heard that side of the matter raised before, and it seemed to him there was something in it. At the same time, it was very largely a matter of having the ratepayers to consider.

Mr. MITCHELL (Deputy City Treasurer of Leeds) said it appeared to him that if the sinking-fund period, as determined by authority, was the correct one, nothing more need be done in the way of providing for depreciation than providing for the reduction of the debt within the period. If it were proved that any other sums were necessary in order to provide for improvement, it was proof positive that the sinking-fund period had been too long, and if that were proved, local authorities would be well advised to shorten the loan period and set up a sinking fund.

Mr. W. LANG thought Mr. Cook would be disappointed to find that the matter was discussed so largely from the point of view of expediency, because it should not end with that. There were, however, many factors to be taken into account which were not mentioned in the paper at all. There was, for example, the rise and fall of the bank-rate. That was quite a material item in relation to depreciation of very large undertakings, where money was put in a sinking fund, and was not available for very urgent repair work, or renewals or extension work which could not be delayed.

Mr. J. E. STORR said he disagreed with the authors' statement that depreciation should be included in the annual charges of all plant, seeing that depreciation was defined as including the improvement or replacement of obsolete plant. That conclusion should be modified, because at least a third of the electrical plant assets were not subject to obsolescence.

Mr. WALTON (accountant, of Leeds) objected to the sinking-fund method on the ground of the difficulty in getting business men to give attention to anything so complicated. It was only by the straight-line method and the reducing method that business men could be got to appreciate the true effect of depreciation. He always recommended the reducing balances method.

Mr. W. M. SELVEY said it appeared to him that in the case of a company whose stock or shares were equivalent to a gilt-edged security every method, however theoretical, which could be adopted to define accurately the exact financial position of a concern should be adopted. But the bulk of businesses could not be so described, and what the man in a speculative kind of business wanted to know was not what his capital was, but what he turned over, and what he made on it. He did not want to know what he was worth until he wanted to turn it into a limited liability company, and then he found he was worth a great deal more than he had ever imagined! As to a company that was in the stage of developing, there was a certain sort of value called goodwill, which could not be called capital, and in regard to which the argument was that it was not only legitimate, but necessary to draw on that goodwill in a sense by not placing to depreciation a certain amount of the gross profits in any particular year, because of the necessity of keeping up the face value of the actual shareholders' capital. The goodwill in a long-established company was practically written off, inasmuch as it appeared as a reserve fund, which was drawn on in case of necessity in order to keep up the perfectly steady depreciation which must be set aside if the actual financial position of a company was to be accurately ascertained. When the company reached that stage the most perfect theoretical method available must be applied.

The CHAIRMAN (Mr. T. ROLES) said the paper had been a most useful one to engineers. In Bradford, the Corporation paid back an equal amount of capital yearly, so that the interest on capital should be a varying amount. The loan terms were shorter than they had been in many other places, and, whatever the earlier engineers might have thought about it, that had proved fortunate for those who had followed. In the early stages, in addition to the sinking fund, a certain amount was set aside for depreciation, and after about 15 years that amounted to a considerable sum. It was then decided that the whole of the books should be handed over to the city treasurer, and he took the whole of the depreciation from the various assets, and made an appropriation fund. The fund had largely been used as an improvement fund, and the present consumers were very much indebted to the original consumers for providing this money, because it had enabled the Electricity Committee to effect very considerable improvements in plant, and to scrap plant which would otherwise have had to be used because additional money could not be borrowed. It appeared to him that the great point brought out by the authors was that depreciation should be divided into two parts, to provide for the diminution in value of plant in place, and the taking of plant out of commission before its physical life had been exhausted. Although the periods of the loans might reason-

ably be assumed to be the life of the assets, it was often found economically advisable to throw out old generating sets before they had actually come to the end of their physical lives, and considerable economies had been effected in the Bradford experience by so doing. With regard to the authors' two alternative ways of commencing an installation, it was not always recognised that it was often better to spend more in connection with the first cost of plant than to spend less. Results were in favour of the more expensive plant. He believed that municipal electrical committees had a very bad name in this connection. They almost invariably went for the lowest tender, and what happened was that they had to pay much more in the way of maintenance, and they should pay very much more in depreciation, though whether the depreciation was allowed for was a question.

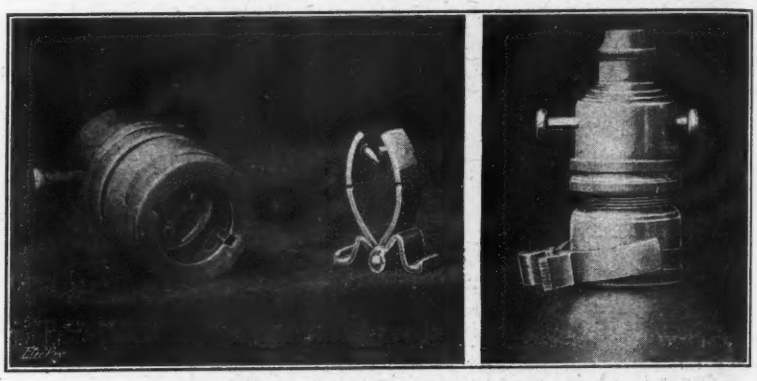
Mr. Cook, in replying on the discussion, said that if what the accountants had said really represented their attitude, he and his colleague had failed in what they had been trying to do. They had tried to set out the principles for computing the depreciation of plant chiefly from the engineer's point of view, and before anything could be done in that way the accountant must understand the engineer's point of view. It was equally true, of course, that the engineer must understand the point of view of the accountants. Someone must make a start towards that mutual understanding, and that was why they had done it. Some of the difficulties of the owner or employer were undoubtedly due to the fact that the accountant was pulling one way and the engineer the other. If these two could agree upon principles and act together they would have more influence on the owner. One of the ways in which an agreement on a method would be helpful would be by getting agreement between the Local Government Board and the income-tax authorities. At present they could not reconcile the methods of the two authorities with each other, and probably not either of them to the facts. To express it roughly, the difference between the two authorities was very largely a question of one acting on the physical life and the other upon the economic. He could not agree for a moment with what had been said about the difference between good and bad years in reference to depreciation. Whether the year was good or bad, depreciation charge was a working cost, and if they were not able to meet it in one year they must carry it forward in some shape or other. A good deal had been made of the extra labour involved in book-keeping by the sinking-fund method. There were generally such objections to new methods, but he had not found this one to be substantial in actual practice. Mr. Selvey's contribution to the debate was a very valuable one which would take some thinking about, and he would defer his reply.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

The "Thab" Patent Lamp-Lock.

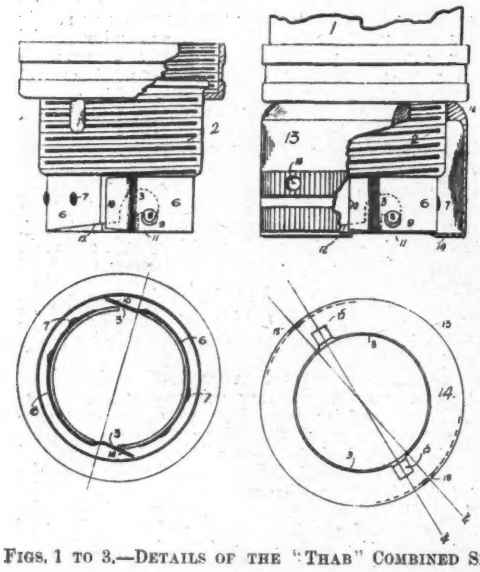
Mr. T. H. Alex. Brown, of the Heidelberg Municipal Electricity Works, Transvaal, South Africa, has developed an ingenious and effective type of combined shade carrier and lamp-lock, which is illustrated herewith. The necessity of a locking device for tungsten lamps is keenly felt in South Africa, and we are informed that there is a wide open market for a lock which can be depended upon to retain the lamp securely in its socket.

The device consists essentially of an ordinary bayonet-socket holder provided with two spring latches, which allow the lamp to be inserted in the socket and then snap upon the pins, so that the lamp cannot be moved in any direction. To remove the lamp a special key is necessary, with which the latches are lifted out of the way while the lamp is withdrawn. Combined with the lock is a shade carrier which forms an essential part of the device. The details are shown in figs. 1—3, and views of the parts are given in figs. 4 and 5. In the lampholder 1 the lamp socket 2 has an external thread and bayonet slots 3, engaging the pins 4 of the lamp cap 5. Flat spring latches 6 are riveted to the socket at the end 7, and are provided with holes 8 opposite the inner ends 9 of the bayonet slots; the free ends 10 of the springs are bent outwards, so as to be lifted by the entering pins, and the edges 11 of the springs with the socket are tapered away as shown at 12, to ensure that the pins will fairly pass under the springs when the lamp cap is inserted and turned round in the socket. The barrel 13 screwed on the socket has a flange 14 at the lower end, which covers the springs 7, the flange being provided with slots 15 to admit the pins; the upper end 16 of the barrel is curved to suit the usual patterns of lamp shade, and holes 18 are provided in the barrel for the insertion of the releasing key. The key consists of two arms 19, hinged together at 20, with a spring 21 which tends to close the arms; grips 22, when held between the finger and thumb, enable the key to be held open while inserting the pegs 23 in the holes in the barrel. The manner in which the pegs lift the latches is shown in fig. 3, the lamps and socket being rotated with one hand, whilst the barrel and key are rotated with the other until the pins are released and the lamps can be removed, the slots 15 being then opposite the open ends of the bayonet slots. Usually the shade is carried above the lamp lock and barrel; on the other hand, some shades closely embracing the lamps cannot be fixed in this way. A lamp cap ring is then slipped over the cap, and rests on the shoulder of the cap, the shade is placed on the ring, and, after the lamp has been inserted in the socket, the barrel is screwed down to grip the shade securely, as in fig. 5.



Figs. 4 and 5.—The "Thab" Lamp-Lock and Key.

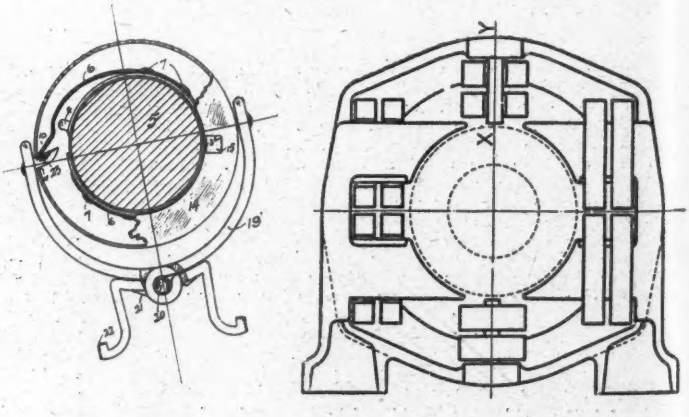
The inventor has kindly sent us a model of the device, which we find bears out his claims, and it appears that it would take a very clever thief to detect the method of locking and succeed in removing the lamp.



Figs. 1 to 3.—Details of the "Thab" Combined Shade Carrier and Lamp Lock.

Burleigh Dynamos and Motors.

Some years ago (November 26th, 1909, and January 5th, 1912) we published descriptions of D.C. motors with commutating poles



Cross Section

Fig. 6.—Diagrammatic Section of Burleigh Field-Magnet System.

and cast-iron magnets, in which the field-magnet system was designed on a novel principle, for which many advantages were claimed. These machines are being made by MESSRS. NEWTONS, LTD., of Taunton, under Mr. J. W. Burleigh's patent, and particulars of them are embodied in a list recently issued by the firm. The essential feature of the design is the special arrangement of the four-pole field, as shown diagrammatically in fig. 6; it will be seen that the poles are arranged in pairs connected by stout yokes, while the interpoles are carried on much lighter yokes, which also form part of the magnetic circuit, the whole of the carcass being of cast-iron. By this construction, while the weight of the machine differs little from that of an all-steel magnet system, less machining is required and the cost is reduced, while equal efficiency and excellent commutating properties are obtained. The magnetic leakage is reduced, and the ventilation is greatly improved, owing to the large spaces provided in the interpole yoke, as shown in fig. 7, which represents an "open protected" motor. Machines built on these lines have been tested at the Faraday House Testing Laboratories, which report that the interpole flux is closely proportional to the armature current, and shows little sign of saturation up to loads of 50 per cent. in excess of the normal

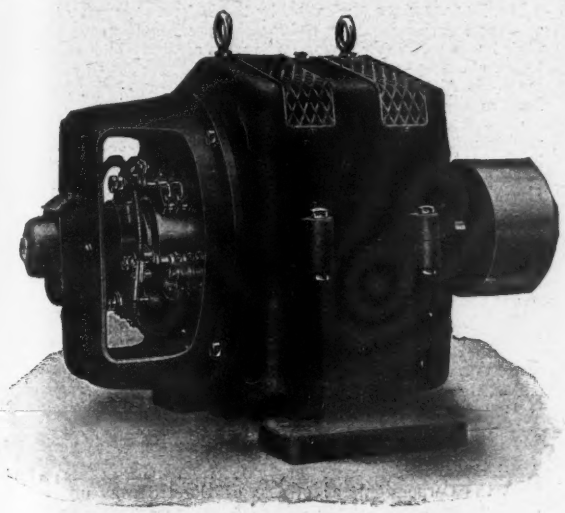


FIG. 7.—NEWTON'S OPEN PROTECTED MOTOR.

output, so that the machine could carry larger overloads than one of the ordinary type. The heat-dissipating properties of the machine are described as excellent, and the weight is not greater than that of steel-frame machines of the best manufacture. In a report on an adjustable-speed 8-H.P. motor of the same type, it is stated that the machine worked sparklessly at all speeds and loads up to 50 per cent. overload, had no tendency to hunt, even with a field of half the minimum strength for which it was designed, and ran silently under all conditions. It also started satisfactorily against full load with minimum field strength as a shunt machine, and gave its normal output continuously at the lowest speed without overheating, with an efficiency of 84 per cent.

The list gives the H.P. and speeds of each size of motor at six different voltages, and also states the efficiency at each speed and loads up to 1¼ full load, an unusual and valuable feature. The outputs run from 1½ to 100 B.H.P., the largest size having an efficiency of 91·5 per cent. at full load. In the case of the variable-speed motors, in view of the unlimited variety of combinations of pressures, powers, and speeds that may be asked for, a simple table has been devised which enables the reader to find with ease the suitable size of frame for any voltage between 110 and 550, with a speed variation of 4 : 1; a range of 6 : 1 can be provided in many cases. In these and other respects the list is exceptionally informative and useful to the engineer.

Pocket-Lamp Extension.

A convenient improvement on the ordinary pocket lamp has been devised and prov. protected by MESSRS. W. R. CURTIS (13, Coniston Road, Muswell Hill, N.) and E. BIGMORE. It consists of a miniature lamp of the usual pattern, provided with a spring clip for attachment to the user's clothing, and connected with a flexible cord, the other end of which is wound on a spring cord-absorber; the case of the latter is furnished with a screw adapter so that it can be attached to the case of the ordinary pocket lamp or torch in place of the lamp. Thus the battery can be carried in the pocket, and the lamp clipped on to the coat-collar or used as a torch to find the kerb, and so on; when not required for use, the cord is automatically coiled up and the lamp is clipped on to the case, which can then be used as a hand lamp in the usual way.

A New Swiss Company.—A new company, under the title of the Elektrotechnische Werke Lauffen, has been formed at Laufenburg, in the canton of Aargau, for the manufacture of electrochemical and electrometallurgical products. The share capital is £30,000, of which one-half has been paid.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Position of Shift Engineers After the War.

The position of shift engineers is only a part of a very large question. It is not only shift engineers who are affected, but it is everyone from chief downwards.

The central-station profession is suffering from a very bad disease, and, unless it can be cured, there is no doubt about the advisability of the first-class men clearing out; they have been doing it for some time now, and the emigration increases every year.

With very few exceptions, every position in central stations is underpaid, but in many cases the men holding these positions are overpaid, and unless the second-rate men are removed by offering a better salary and attracting the first-class man, it is only a question of time before the central-station profession is in the hands of the second-class man altogether.

If the emigration of the best men is going to be stopped, it is up to the first-class chief engineers to do it by offering better salaries for their assistants; the results would be better, and their own salaries would increase in proportion. Of course, you cannot expect the second-class chief to assist in this work, because, if the first-class man stopped, he would have to go.

This question is more than a professional one, it is a national one, because it is necessary for the manufacturers of this country to be supplied with power at a minimum rate, and it can only be done by first-class men from chief downwards.

Suum Cuique.

As a shift engineer of many years' service in different public supply undertakings, both company and municipally controlled, I heartily endorse the greater part of the clear and concise exposition of the state of affairs presented by Mr. John Marks in his article on this subject. As for the great majority never reaching "the lower figure, £250," as their annual salary, I think £200 would be a nearer estimate: the number of shift engineers getting £225 or more might be reckoned on the fingers of one's hands. The article, however, true to life though it is, has dealt with the darker side of the picture, and there is a lighter side, even for an intelligent man with a good education, if he can exercise discretion. For example, the tedium of long hours of light load and uniform running of the plant may be largely dispelled by undertaking literary work of a technical character, which may prove both educative to the writer and others, and remunerative to his bank account. Books, articles of an up-to-date character for the Press, scientific literature, &c., offer considerable scope. Another advantage is that if one wants a day off, it is easily arranged with one's colleagues, and no questions asked, the equivalent of work done by them being repaid at a convenient season, whereas in an ordinary business office to get a day off means an interview with the "chief," with explanations, and then having to ask a favour, for the work of one day cannot, as a rule, be made up on another. When all is said and done, however, in the duties of a shift engineer there is not sufficient scope to satisfy a progressive mind, and in that case the best policy is to

Get Out.

Sources of Error in Thermometry.

I was much interested in the notes by Mr. E. B. Pausey in your issue of December 29th last, as one who has had to battle, often with no very great success, against the prevailing methods of applying thermometers and pyrometers to pipe lines and similar apparatus, and I welcome his very practical remarks on the subject.

The errors which are incurred by the use of a thermometer pocket which has only shallow insertion into the heated zone, and which is of large cross section, may be very large indeed. They are, further, quite incalculable, as they depend upon a number of variables, as pointed out by Mr. Pausey. A case which I have had to meet in which these errors appeared very largely was in connection with electrical pyrometers for use on running locomotives, the temperature being that of the superheated steam. As the case is one illustrating just this class of error, it may be of interest to your readers.

The primary measurement was made by an electrical pyrometer of the thermo-couple type, this being installed with the hot junction actually exposed to the superheated steam in the header of the locomotive. With the special design of thermo-couple employed the conduction effect was practically negligible, and the thermal capacity of the actual thermo-couple junction was very small, therefore the accuracy of the indication of this pyrometer was high, and its speed in following temperature variations quite in advance of anything which could be achieved with a mercury thermometer.

The consulting engineers, however, having that touching faith in the mercury thermometer with a pocket, referred to by Mr. E. B. Pausey, specified that alongside the thermo-couple there should be provided a steel pocket available for use with a mercury thermometer. As the pressure was high, and the consulting engineers were cautious, the thickness of this steel pocket, bored from the solid, was considerable, hence the conduction error was very large. It was really rather amusing to use a mercury thermometer installed under these conditions as a check upon an electric pyrometer of much higher intrinsic accuracy. The result in practice

was that we had to put a caution on the test certificate issued with the electrical pyrometer, that, owing to this conduction effect, the temperature, as shown upon the mercury thermometer, might easily be lower than that of the electrical pyrometer by as much as 10 per cent.

Of course, this error was not only very large, but quite incalculable, because it depended upon three variables—namely, (*a*) the actual temperature of the steel; (*b*) the rate of flow of the steam past the pocket; and (*c*) the temperature of the flange in which the pocket was mounted.

The mercury thermometer is, of course, an extremely convenient instrument for measuring temperature, but the user should realise very clearly that, at the best, it can only indicate the temperature of its own bulb; whether that is the temperature of the material under measurement depends, to a very large extent, upon the conditions in which it is used.

The present tendency in high-temperature operations is very strong towards the use of some electrical method such as the thermo-couple, in which the installation can be made with the least danger of conduction errors, and also with less danger of permanent error resulting from temporary overheating.

Chas. E. Foster,

January 17th, 1917. *Proprietor, Foster Instrument Co., Letchworth.*

Localising a Fault.

Can any of your readers engaged on central-station mains work suggest a simple method of localising a fault as detailed below, somewhere on a length of just about a mile of triple-concentric L.S. and S.T. armoured cable? The system of supply is D.C. three-wire, and the cable in question acts as a feeder and runs from the station switchboard bus-bars to a feeder pillar a mile away, there being en route three S.T. boxes and half-a-dozen T boxes (for house services of two-core cable—no other cable being in the roads this feeder is laid in, some premises have been connected direct from the feeder), but there are no inspection boxes of any kind between the station and the feeder pillar, and the cable is laid from 1 to 3 ft. deep in very hard soil.

Tests proved all the three conductors to be shorted, and each showed a dead earth, but the cable was not burnt completely through. A loop test was impossible, as there was no sound conductor (all three being shorted), and it was also impossible, for many reasons, to drop a length of cable on the surface and so try a loop test.

"Burning out" was, for various reasons, not practicable.

With a search coil and telephone, notes could be heard distinctly over the whole length, though the conductors at one end were entirely disconnected.

The compass method of Mr. R. C. Quin was tried, but proved deceptive, the needle indicating the direction of the flow of current from each end to points a few yards apart, but the fault was not between the two points.

Current for testing purposes was, of course, available at both ends of the cable, but the only instruments available were a general combined house-testing generator set, an insulation testing set, and volt and ampere meters.

The fault, fortunately, was found by chance, but the writer would be glad of advice *re* the best and simplest method to proceed in such a case in future.

Mr. F. C. Raphael's book on localisation of faults does not clearly show how to proceed in cases of burn-outs on triple-concentric or three or four-core L.S. and S.T. armoured cable where "all conductors are shorted and earthed" and where "no spare cable is available to make the loop."

Mains Assistant.

City and Guilds' Examinations.

Your comments on our two previous letters, if you will permit us to say so, afford an excellent example of how the initial scope of a subject can be extended to confusion point.

Our first letter dealt with the two City Guilds' subjects—Electrical Installation Work (late Electric Wiremen's Work) and Electrical Engineering, and compared the treatment meted out to each in technical colleges, &c., and the results obtained.

In your footnote on this letter you brought in references to manufacture, &c., which appeared to us quite beside our point, and we wrote to say as much.

In your footnote to our second letter (see your last issue), you begin by digressing still further, and launch into general remarks about the "respective functions of the technical college and the trade school," "electrical manufacturing as a handicraft," &c. Your mention of "trade schools" (how many are there?) and "handicraft" reminds us of our letters in your columns in November and December last anent final-grade classes in Electrical Installation Work.

You return to the point towards the end of your note, when you place another construction on the percentage results. Some may consider your interpretation correct.

Next you disagree with our original contention that the subject of Electrical Installation Work is grossly neglected. In regard to this, may we tender the same suggestion as we made to Mr. A. P. Trotter in the above-mentioned previous correspondence—viz., that you should peruse the syllabus of the subject, and then walk into the nearest polytechnic and see what they do with it.

Your final remark that "Grades I and II in Electrical Engineering have a direct bearing on wiremen's work" reopens such a field for strong disagreement, that we do not feel equal to the task. You might compare the respective syllabuses.

We regret exceedingly that no teacher of the subject has had the energy to join in this correspondence, as we feel sure that we should have received a good deal of support from that quarter. There are obvious reasons, of course, why men in that position should hesitate to state their views publicly.

A. P. Lundberg & Sons.

London, N., *January 22nd*, 1917.

[We fail to see what bearing this letter has upon the subject.—Eds. Elec. Rev.]

Several other letters are unavoidably held over to a later issue.—Eds. Elec. Rev.

LEGAL.

Secret Process in Rubber Manufacture.

(*Continued from page 83*).

Mr. Ballantyne was called by the Belgium company to prove, as an expert chemist, that the formula used in the manufacture of their hardened rubber was not the same as that which was alleged to have been taken away from the plaintiff company by Manning. He produced 18 formulæ for the purpose of obtaining insulating hard rubber.

Cross-examined by Mr. Hughes, K.C., he said he could not say whether they were formulæ for goods that had been supplied, but he thought so. The least variation in the ingredients might be of great importance. Materials produced from two different formulæ might have the same specific gravity, whilst in materials produced from the same formula one might get considerable difference in specific gravity.

Mr. Hughes said that was not the experience of rubber manufacturers, and Witness said he had had no experience in rubber manufacture, but had considerable experience of rubber as a chemist. He had no doubt that the first test between rubber manufacturers and their customers was specific gravity.

Further evidence was called for the defence, and, counsel having addressed the Court on behalf of their respective clients, his Lordship reserved judgment.

Liability of Tramway Authorities.

At the Newcastle-on-Tyne County Court, on the 19th inst., a typist sued the Corporation, as owners of the tramway undertaking, claiming damages for the loss of a suit case, valued at £9 15s., which she handed to the conductress, who placed it at the back of the car. The plaintiff paid 1d. in respect of the parcel and received a ticket for it. When she alighted from the car the case could not be found, having probably been removed by another passenger. For the plaintiff it was submitted that the Corporation, by accepting the luggage, became common carriers, and it was contended that they had broken their obligations as common carriers. For the Corporation it was argued that they were not common carriers; the only obligation upon them was that a passenger could carry with him 28 lb. of luggage. The plaintiff had failed to prove any negligence. His Honour asked why the charge of 1d. was made; why should they make a charge and accept no responsibility? For the Corporation it was replied that the charge was for the carriage and not for insurance. His Honour reserved judgment.

Moraine *v.* The United Electrical Manufacturing Co.

In the Lord Mayor's Court, on Monday and Tuesday, this case was heard before the Recorder (Sir Forrest Fulton, K.C.) and a jury. The plaintiff, Mr. M. N. Moraine, commission agent, residing at Berkhampstead, and now in Government service, sued the defendants, manufacturers of electric pocket lamps, torches, and batteries, of Moor Lane, E.C., for 10 per cent. commission upon orders for electric pocket lamps and batteries procured by him for the defendants.

Mr. W. Eddy was counsel for the plaintiff and Mr. A. Morley for the defendants.

According to the plaintiff's case, in November, 1914, the outbreak of war having put an end to his business, he discovered there was a demand for electric pocket lamps and batteries, and became acquainted with Mr. Pordes, of the defendant company. In June, 1915, Mr. Pordes entered into a verbal agreement whereby plaintiff was to receive 10 per cent. commission on all orders introduced by him to the defendant company. The plaintiff had a list of 250 customers given him, and a private connection of his own. The plaintiff was successful in obtaining orders, and worked up the business for four months. He then received a letter from the defendants stating that no more orders could be received through him for the Solar electric pocket lamp, and that if there was any money due to him, they would be pleased to let him have it. Upon the orders received by the defendants, as a result of plaintiff's efforts during the short interval of time, there was due from them 10 per cent. commission. At the time of the commencement of the proceedings, as a result of the inspection of the defendant company's books, there was found to be due a sum of £50, and that was the sum the plaintiff now sought to recover. The plaintiff had been prepared to have the matter dealt with by the Registrar of the Court at a reference where an inquiry into various items could be better proceeded with, but to this course the defendants objected.

Counsel for the defendants said that the reason for the objection to having the matter referred to the Registrar of the Court was that there was a dispute between the parties as to the terms of the verbal agreement, and there were items in the plaintiff's claim for commission which had reference to orders executed long before the agreement relied upon by the plaintiff was entered into. The defence was that up to the time of the proceedings the plaintiff had been paid all that was due to him. A sum of £25 was paid into Court to satisfy the plaintiff's demands.

The jury found a verdict for the plaintiff for £48 15s. 2d., an order being made for the money in Court to be paid out to the plaintiff.

WAR ITEMS.

War Trade Department.—After Monday next, all communications for the War Trade Intelligence Department should be sent to the new address, 1, Lake Buildings, St. James's Park, near Storey's Gate, Westminster, S.W.

Badged Electricity Workers.—A correspondent says that electricity authorities have been notified by the Ministry of Munitions that all war service badges and certificates held by men of military age, and graded as unskilled or semi-skilled, are to be withdrawn.

Trading With the Enemy.—The "London Gazette" for January 19th contains further lists of firms and bodies in the following countries with whom trading is prohibited:—Argentine, Brazil, Denmark, Ecuador, Greece, Netherlands, Norway, Spain, Sweden, &c.

Manchester War Bonus.—The Manchester Corporation, in refusing the application of the Corporation officials for a war bonus of 10s. a week, has resolved that each Committee will reserve its own judgment as to the necessity for raising salaries or not.

Raw Materials and Men in Germany.—Addressing the shareholders, at the recent annual meeting in Berlin, of the Siemens & Halske Co., Arnold von Siemens is reported to have stated that all the company's works were in full operation, and there was no lack of orders. The prospects were dependent upon the extent to which raw materials and labour were available. As the company had important duties to fulfil, it was probable that raw materials would be placed at its disposal to the desired amount. The course of conditions after the war would chiefly be characterised by the paths assumed by statesmanlike administration.

At the meeting of the Schuckert Electricity Co., of Nuremberg, the chairman announced that a large stock of orders was brought over into the new financial year, and further orders had since been received, which were greater than in the corresponding period of 1915. As a consequence, the company could again reckon on obtaining satisfactory results insofar as men and raw materials were rendered available to an adequate extent.

Carlisle Electricity Department.—We have before us two lists showing the part that is being performed by the staff of the Carlisle electricity department with the Forces and with the Volunteers. Twenty-two names are given in the first list, which includes the station superintendent, Mr. H. P. Baynham, who is Company Sergeant-Major in the Royal Marine S.M., the chief clerk, and other members of the office and station and outside staff, also five apprentices. The second list, which contains 24 names of men in the Volunteers, is headed by Captain F. W. Purse, the city electrical engineer, followed by his chief assistant, Corporal J. H. Thompson, and members of the office, station, and outside staff.

Tramways and Substitution.—The Secretary of the Tramways & Light Railways Association wrote to members of that body, under date December 27th, 1916, as follows:—"I beg to inform you that the following arrangement has been come come to between the War Office and this Association, on behalf of its members. I am authorised to say that if you will supply the War Office with a list of all your employés who are now in the Army (at home or abroad), steps will be taken to ascertain if they are in a low medical category, and if this is the case, arrangements will be made to exchange them for general service men to be released by you. The list should contain the man's name and initials, his regimental number, rank, unit, and, wherever possible, where he is stationed. You are also requested to give the names, &c., of men now in your employ who will be available as substitutes for the men released from the Army. The lists should be sent at the earliest possible moment direct to the Secretary, The War Office, S.W., D.R., 4 Department."

Dr. Walter Rathenau Again.—We reproduce from the American *Literary Digest* for January 13th, just to hand, the following article on "Germany and the Next War."—"No lasting peace appears, whatever may be the official views of the Government, to enter into the calculations of some of the captains of industry in Germany, at least, if the views of Dr. Walter Rathenau are typical. As the head of one of the greatest electrical industries in the world, the Allgemeine Elektricitäts Gesellschaft, popularly known as the 'A.E.G.,' Dr. Rathenau occupies high rank among the commercial magnates of the Fatherland, while his genius for organisation is such that, since the war began, the task of mobilising industry has been committed to his charge by the Government. Under these circumstances, Dr. Rathenau's utterances acquire special significance, and it is somewhat of a shock to find an article from his pen in the Berlin *Lokal Anzeiger*, in which he discusses the need of industrial preparation for a future war, which he apparently regards as inevitable. He says:—

"'We began the war a year too soon. When we have secured a German peace we must begin at once a reorganisation upon a broader and firmer basis than ever before. Establishments that produce raw materials essential to the Army must not only continue their work, but enter into it upon lines of increased energy, forming thus the kernel of economic Germany in preparing in the economic sense for the next war. We must carefully calculate in advance, in view of lessons learned in this war, what our country lacks in raw material or essentials of raw material, and secure immense reserves to remain unused until a day in the future. We must organise as genuine an industrial mobilisation as we had a military mobilisation. Every technician or semi-technician, enrolled or not in the list of mobilised, must be empowered through official credentials to take charge and direction of a given establishment upon the second day following a new declaration of war. Every establishment manufacturing for commercial purposes must be mobilised also, and understand officially that upon the third day after declaration of war its entire abilities are to be devoted to serving the Army upon demand.'

"'It must also be determined in advance just what quantities and sort of essentials such establishment can furnish the Army in a given time. Each establishment also should be required to furnish a detailed list of workmen who can be dispensed with, these alone to be mobilised in the military sense.'

"While preparations must be made at home, Dr. Rathenau would have the diplomats of the Fatherland busy abroad in order that some of the experiences of this war may be obviated in the future. He writes:—

"'We must finally establish some definite commercial understanding with nations outside Europe that will offer them advantages, to be duly specified in detail, whereby these nations, as neutrals, will find it to their direct disadvantage commercially to trade or sell munitions during war to either ourselves or our enemies. We can afford to offer such conditions. And, finally, when the next war comes, it must not be a year too soon.'

"These frank utterances from one of the leading capitalists of Germany have produced in France a marked reaction against peace, and we find that brilliant French author and academician, Mr. René Bazin, using Dr. Rathenau's article as a text for an impassioned appeal to the United States not to insist too strongly on peace proposals at the present time."

Exemption Applications.—At Pontefract, exemption was claimed by Mr. J. L. Brown (25), who asserted that he was the only electrician in the town. In reply to a question, Major Renny said that he did not think that applicant would be able to enter the Navy, but he might enter the Engineers as a linesman. The appeal was dismissed, applicant not to be called up until April 1st.

At Bromley (Kent), Mr. May, secretary to the local Electric Light & Power Co., applied for exemption, and said that he was in the Naval Air Service. The Tribunal decided that they had no jurisdiction, and dismissed the application.

At a sitting of the Canterbury Tribunal, on January 15th, an appeal was made by Mr. Sidney Terry (29), electrical engineer, for himself and an employé named Reginald A. Elliott. Mr. Terry stated that he had charge of all the electrical plant, dynamos, and lighting at a local munitions works and at the premises of the Motor Co. The Advisory Committee recommended three months to Mr. Terry, and no time to the employé beyond a month's grace before the calling-up. Mr. S. Shea, for Mr. Terry, asked if the three months could be extended, as there was such a scarcity of skilled electricians. Mr. Terry was given the three months, and the case of Elliott was put back for medical classification.

At Woking, the Electric Supply Co. appealed for the retention of S. C. Bicknell (38), electric wireman and repairer. It was stated that Bicknell was one of only two men left to maintain the repairs over the company's area, and before the war they had 10 men doing similar work. It was impossible to obtain an experienced man in his place. Six months granted. The Military Representative suggested that efforts should be made to replace Bicknell, who is in Class A, by a substitute out of the Army before the six months expired.

At Whitehaven, on January 17th, an electrician appealed for the retention of his son, aged 31, the only experienced man left to undertake electrical work at collieries, &c. The Advisory Committee recommended conditional exemption, and this was agreed to.

At Chatham, 10 employés were appealed for by the Tramway Co., their exemption certificates having been withdrawn. With the consent of the Military, two were again given conditional exemption, and the rest were temporarily exempted, pending substitution.

The South Staffs. Appeals Court has given conditional exemption to an electrician in charge of a generating station at Rowley Regis under the Government, who intimated that they required appellant's services.

The Isle of Thanet Electric Tramways & Lighting Co. appealed at Broadstairs, on January 16th, for conditional exemption for an employé, aged 36, engaged as a wireman and driver, repairer of trucks, &c. Conditional exemption until the company finds an efficient substitute.

On the appeal of the Electric Traction Co., Ltd., the Peterborough Tribunal have granted the following exemptions:—J. Culshaw (34), chief traffic inspector, in B 1, conditional exemption; J. G. Manning (28), electrician, Class A, one month for substitution; C. W. Armitage (29), tramway foreman, Class A, a month for substitution; G. A. Maywood (33), fitter and mechanic, a month for substitution; F. G. Jessop (29), mechanic and driver, B 2, conditional exemption; E. A. Sewter (30), electric fitter, &c., B 2, three months.

At Taunton, the Corporation electricity department appealed for W. P. Short (28), ledger clerk, book-keeper, and relief switchboard attendant, in Class B 1. The electrical engineer (Mr. Howard) said that the man was indispensable to the supply of current for power and light to munition and other works. Six months' exemption was granted.

At Eastbourne, an electrical engineer appealed for the retention until the end of March of an apprentice, aged 19, and passed for general service. The employer said that by the time stated he hoped to get three boys efficient in the work. The appeal was rejected.

At Farsley (Yorks.) Tribunal, the Morley Electrical Engineering Co. claimed for six men, all of whom, except one, came under the "Trade Card" category. The one, H. Moore, armature winder, was 26 years of age, and it was suggested that he would have to be refused owing to his age, though the firm might claim him under their engineering scheme. The Tribunal could not agree to him being in a certified occupation. Mr. W. Summerscales (the manager of the company) said it was singular that when the Government made the arrangement with the Trade Union no provision was made for foremen, but the Employers' Federation were considering the question. Moore had charge of the department which made motors for driving machinery for Russia, France, Italy, and Australia. All the hands under him were only about 17 years of age, and if he were taken the department would have to be closed. He was a highly skilled man. The Clerk having given it as his opinion that Moore's age did not now debar him from conditional exemption, this ruling was accepted, and he, with the other five men, was conditionally exempted to March 31st. The other men were F. L. Bell (34), draughtsman and designer; J Hartley (36), turner; L. Magson (30), engineer's blacksmith; W. Pearson (40), pattern maker; and F. H. Platts (37), electrical fitter.

At Northampton, Henry Sale, a cartage contractor, appealed for the exemption of his son Harry, aged 30, married, with three children. He said that he and his son were in partnership, and they both worked in the business, and employed two other men. They had a contract running for the carting of the whole of the coal used by the Northampton Electric Light & Power Co., and that occupied the whole of their time. They had that day carted 74 tons. It was suggested that the man appealed for could be replaced, but Sale said that was impossible; there was no labour available. Ald. F. H. Thornton, the chairman of the Electric Light Co., pointed out that the company was an important branch of the public service, and said it would be very difficult to find a substitute. Three months' final was given.

Before the Henley Rural Tribunal, Mr. R. C. H. Harrison, of Shiplake Court, appealed for the retention of R. A. Pride, engineer in charge of the electric light installation. Conditional exemption was granted until May 1st, subject to substitution.

At Bexhill-on-Sea, Mr. R. W. Waine appealed for J. Bloor (35), electrician, classified for labour duty abroad. The Military agreed that he was of more use in civil life, and did not oppose temporary exemption. Three months were conceded.

At Oxford, the Military Representative asked for a review of the case of W. T. Cooke (28), electrical fitter and mechanical lead burner, with Messrs. Hill, Upton & Co., electrical engineers, granted conditional exemption to June 26th. On behalf of the firm it was stated that Cooke was the only one now left to do his work, three others having left for the Army. The firm were engaged in considerable munition work, and Cooke was chiefly engaged putting in machinery at munition works. He had sole charge of the installation of machinery, and had to go all over the country. It was mentioned that the firm had a trained lady electrician, the only firm, it was believed, in the country who had one, and that 90 per cent. of the firm's work was indirect war work. Captain Fox said that there was a great demand for men of Cooke's stamp in munition works, and in the Royal Flying Corps. The Tribunal held that Cooke was engaged on work of national importance, and they confirmed the conditional exemption.

At Oxford, the Electric Light Co. asked for exemption for Mr. J. F. Pierce (39), chief assistant engineer, two fitters and turners, a shift foreman, three switchmen, an improver, a motor mechanic and tester, an electrician, and a stoker. Mr. F. Gray, for the company, said that they had 14 men of military age, but they had to supply current for power to munition works in the district. Of the 14 men, 10 were passed for general service, and four had been rejected. He suggested that one should go at once, two should be released if efficient substitutes were found, and seven exempted for three months on condition that during that period every effort would be made to find substitutes. It transpired that the improver had joined up, and Mr. Gray's suggestion as to the rest was agreed to, Mr. Pierce being with those exempted for three months.

BUSINESS NOTES.

Australian Contracts.—The Victorian Railways Department has agreed to include in all contracts accepted the name of the country where any such articles or goods or material are manufactured.—*Tenders.*

British Industries Fair, 1917.—Manufacturers who are exhibiting at the British Industries Fair have received their allotments of space from the Board of Trade during the last few days, and the work of erecting stands has already begun. The total amount of space applied for has again largely exceeded the space at the Board's disposal, with the result that exhibitors have found their allotments considerably reduced. In some cases it has even been found necessary to reduce the applications by half. The space covered by the Fair will be considerably larger than last year, and the number of exhibitors will also be greater.

The Fair will open on the last Monday in February (February 26th), and will remain open till March 9th.

The London Fair, like all such undertakings, comes under the restrictions imposed by the Ministry of Munitions, and, consequently, certain trades, which would otherwise be included, cannot participate. As before, the direct interest of the electrical trade, as exhibitors, is naturally very limited, for in London the trades included will be toys and games, earthenware and china, glass, fancy goods, stationery and printing.

The Glasgow British Industries Fair will cover textiles, ready-made clothing, boots and shoes, foodstuffs, and domestic chemicals.

At the London Fair the charges for space will be 2s. a sq. ft., and exhibitors have no other expense except the cost of the erection of their stands. At last year's Fair many exhibitors had stands as small as 6 ft. × 6 ft., and their total expenses, including the erection of their stands, probably did not exceed £7. None the less, many of them booked orders for several thousand pounds.

Bankruptcy Proceedings.—CHRISTIAN EVAN EVANS, 93, Cannon Street, E.C., financial agent.—An application for an order of discharge was made on January 17th to Mr. Registrar Linklater at the London Bankruptcy Court. Mr. Daniel Williams, Official Receiver, reported that the bankrupt failed in August, 1914, with provable debts £2,034 and assets expected to eventually realise £170. In December, 1912, the bankrupt, in consideration of shares valued at £300 (borrowed from a creditor) and £50 cash, acquired an interest in a patent for the Boran electric lamp, which was then being exploited by third parties. The lamp was to be manufactured by a company, but the latter went into liquidation and the lamp was never placed on the market. The bankrupt estimated his loss on the venture at £350, and the creditor from whom he borrowed the shares had proved against the estate for £500. The application was opposed by the Official Receiver on the grounds (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) omission to keep proper books of accounts; (3) contracting debts provable in bankruptcy without having at the time any reasonable or probable ground or expectation of being able to pay them; and (4) rash and hazardous speculation. His Honour upheld the report, and imposed a further suspension of two years. Order entered accordingly.

J. R. WHITEHOUSE, managing director of an electrical company, 43, St. Andrew's Road, Golder's Green, Middlesex.—This debtor applied to the Judge sitting at Barnet, on January 23rd, for his discharge. The Official Receiver stated that the liabilities were £630, and the assets, which were estimated at £385, had only realised £31. Debtor was now in employment, and receiving £125 a year. His conduct during the bankruptcy proceedings had been unsatisfactory. The solicitor appearing for the debtor said that the failure had been brought about owing to the war, and asked his Honour to treat his client leniently. His Honour, however, said it was a very bad case, and he refused the application.

Calendars and Diaries.—From MR. GEORGE ELLISON, of Birmingham, we have received a small desk calendar on metal base, with daily turn-over date-slips. Rather a large proportion of the space is occupied with the various addresses of the firm, but a small memoranda space is left, in addition to which one has before one each day a calendar for a complete three months.

THE S.R.O. BALL BEARING CO., of 115, Southwark Street, London, S.E., have sent us a clearly dated calendar for 1917, with monthly sheets, at the right-hand side of which is a daily memoranda space. Copies may be obtained on application.

The London Association of Foremen Engineers has sent us a copy of its diary, containing particulars regarding the Association, list of members, engineering data, &c. Referring to the tables of metrical equivalents, which are carried to the millionth of a centimetre, the 10-millionth of a ton, and the 100-millionth of an inch, we would suggest that these figures are enough to frighten anybody; all that is necessary in practice is four or five significant figures. The diary is neat and handy, and contains an insurance coupon.

Swiss Trade in 1916.—According to information collected and published by Swiss financial institutions, the iron and steel and engineering industries in Switzerland had an abundance of orders during the whole of 1916. Considerable difficulties, however, were experienced in obtaining raw materials; the prices reached an exceptionally high level, and this fact and the advance in wages, caused a large increase in the cost of production. The electrical industry was characterised by an active course of business at good selling prices, and the prospects are declared to be decidedly satisfactory.

Catalogues and Lists. — BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park.—Fourteen illustrated leaflets, containing particulars, and in some cases prices, of the following manufactures:—Contactor control gear, ironclad switchgear, electric motors, heating apparatus, wire-drawn lamps, rotor starters, reversing controllers, motor-control panels, and lightning arresters and multi-gap surge dischargers.

BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Descriptive List No. 2,269 (eight pages), containing illustrated particulars, with fully-tabulated dimensions, of their crane and hoist motors.

SPRAY ENGINEERING CO., Boston, U.S.A.—Bulletin No. 250 (16 pages), containing a fully-illustrated description of their "Spraco" equipment for washing and cooling air, especially applicable to steam turbo-generators and other electrical machinery.

ELECTRICAL SUPPLIES CO., 233, Tottenham Court Road, London, W.—Folder, giving prices of "Lighthouse" cinematograph carbons.

MESSRS. E. BENNIS & CO., LTD., of Little Hulton, have issued No. 3 (December) of their journal "Cheap Steam."

Liquidations.—IMMISCH LAUNCH & BOAT CO., LTD.—A meeting of creditors is called for January 26th at Electrical Federation Offices, London.

STENTORPHONE SYNDICATE, LTD.—Creditors are to send particulars of debts, &c., to Mr. A. A. Baster, Whitgift Chambers, North End, Croydon (the liquidator), by February 20th.

KILOWATT PUBLISHING CO., LTD.—Creditors must send particulars of debts, &c., to the liquidators, Messrs. A. Webster and E. A. Burnie, by February 16th.

Trade with Canada.—H.M. Trade Commissioner in Canada and Newfoundland (Mr. C. Hamilton Wickes) is to pay a further official visit to this country. He is expected to arrive early in March, and will be prepared to interview (by appointment) representatives of firms who may be able to see him in London at the Offices of the Department of Commercial Intelligence of the Board of Trade for several weeks before Easter. Immediately after Easter he will visit certain trade and industrial centres in the United Kingdom. Firms who may desire to have an interview with Mr. Hamilton Wickes are requested to make their application not later than February 19th in the case of London and March 5th in the case of the Provinces. Applications should be addressed to the Comptroller-General, Department of Commercial Intelligence, 73, Basinghall Street, London, E.C.

For Sale.—The Llandudno U.D.C. invites offers for 1,325 yards of lead-covered insulated cable; the Erith U.D.C. is inviting offers for the sale of a Bettington boiler, and several A.C. generating sets (125 KW. and 50 KW.). Full particulars are given in our advertisement pages to-day.

Trade Announcements.—MESSRS. J. HALLIWELL & SONS, electrical and mechanical engineers and contractors, having opened new premises at 7, Church Road, Seacombe, Cheshire, desire to receive catalogues, &c., of electrical and mechanical machinery, tools, and accessories; also samples of cables, wires, &c.

MR. CHARLES HASWELL, of Sherbrooke Chambers, 8, Norfolk Row, Sheffield, has been appointed the agent of Messrs. Crompton and Co., Ltd., London and Chelmsford, for Sheffield and the surrounding district.

Exhibition.—According to the *Financier*, it has been decided that the Shipping, Engineering, and Machinery Exhibition, which it was originally intended to hold in September and October, 1914, but which was postponed owing to the outbreak of war, is to be held at Olympia after the conclusion of the war.

Book Notices.—The *Journal* of the Tramways and Light Railways Association for January contains a full list of members of the Association.

"Willing's Press Guide for 1917." London: Jas. Willing, Ltd. Price 1s.

"L'Entente": Revue Politique, Economique et Financière. No. 1. January 15th, 1917. Paris: A. Pamaron, G. Prade. Price 3 fr.

LIGHTING AND POWER NOTES.

Aldershot.—The U.D.C. has acceded to the application of the postal authorities to give a supply of current to the new post office premises, and to supply other premises en route when the extension of the mains is carried out.

Australia.—According to the *West Australian*, the new East Perth (W.A.) power station has now been brought into use for both tramway and general supply.

Bandon (Co. Cork).—The Town Commissioners are considering a scheme for electric lighting.

Banbridge (Co. Down).—E.L. PROPOSAL.—At the last meeting of the U.D.C. it was resolved to ask for tenders for the lighting of the town, either by gas or electricity. Banbridge is a steadily-improving town with mills, factories, &c., situated on the Upper Bann.

Continental.—SPAIN.—A new hydro-electric generating station established by the Compania Mengemor, near Mengibar (Province of Jaen), has lately been completed and put into operation. The plant, which utilises the power of the Escalas Falls on the River Guadalquivir, will supply current for lighting and power purposes in the district.

RUSSIA.—In a study of the resources of the Caucasus in connection with the development of industries in Russia, it is stated that the hydro-electric installations in the cities of Hagri, Suchum, Novycaphon, Batoum, Artvis, and Borzham have a total capacity of 15,000 H.P. Hitherto this has been utilised locally, but a portion might be diverted to chemical purposes. The Commission which carried on the investigation has opened up negotiations with important firms for the installation of electric furnaces for the production of nitrates in the Caucasus.

Caucasian newspapers report that the employment of water-generated energy from the Rivers Kaban and Maloi-hata is under investigation. The Council of the Viceroy of the Caucasus has approved the chief heads of a contract with J. Nikolenku for a period of 75 years, ceding sites on these rivers, but with a Government right of purchase within 30 years. The capacity of the central station is estimated at 45,000 KW., and exceeds that of all the other installations in the Caucasus combined, their total being 30,000 KW., without reckoning the plants employed in the mining industry.

Dartford.—The electrical engineer has forwarded the following particulars to the I.M.E.A. on the effect of the working of the Summer Time Act on the quarter's revenue ending September, 1916, as compared with the previous year. The reduction in sales for lighting purposes only was 30 per cent. (cinemas, &c., not included); saving in coal for quarter, 13 tons (estimated); saving to lighting consumers, £120. The charges for electricity were not raised in anticipation of a loss in revenue due to the Act.

Dublin.—The various reports arising from the Special Inquiry were on the Corporation agenda for a special meeting last Friday, but, owing to the length of time occupied by other business, it was decided to postpone the discussion until the February meeting.

The Electricity Supply Committee has submitted to the T.C. a further report protesting against the procedure adopted by the Special Committee of Inquiry, urging that the expert engaged to advise it should have been the chief engineer of a British central station, and pointing out that the expenditure of large sums of money at the present time on extensions and alterations at the power station is impracticable. The Electricity Committee also claims to have made arrangements which guarantee the maintenance of an undiminished supply of electricity, and again asks that the report of the Special Inquiry Committee shall be referred to it for investigation and report.

At the final meeting for the year of the Electricity Supply Committee, the outgoing chairman (Mr. J. J. O'Neill) said it was a matter for congratulation that they were able, during the last completed financial year, to pay off just over £32,000 of capital raised, and, in addition, to pay £24,000 in interest and make a profit of nearly £9,000.

The Corporation has decided to borrow, for the extensions of the electric lighting system, sums of £28,000, £60,000, and £12,000, and, under sanction of the L.G.B., has authorised the borrowing, for the purpose of the utilisation of the electric tramway system for the conveyance of refuse, and the provision of a depôt, the sums of £7,700 and £4,500.

According to Mr. P. J. McAndrew, a local consulting engineer, arrangements are now being made to proceed with the scheme for the utilisation of water power in Ireland for electrical purposes.

Dundalk.—INQUIRY.—This week a L.G.B. inquiry will be held into an application by the Council for a loan of £5,000 to carry out extensions to the electric lighting system of the town and district.

Ewell.—PROV. ORDER.—The P.C. has appointed a Committee to interview the South Metropolitan Electric Tramways and Lighting Co. regarding its application for a prov. order for the area.

Gillingham (Kent).—The T.C. has entered into a further contract with Recess Screws, Ltd., for a supply of current on the basis rate of 1½d. per unit, subject to a sliding scale.

London.—POPLAR.—Owing to the growing difficulty in obtaining carts, the Electricity Committee has decided to purchase out of the profits of the current year a second Foden steam wagon, at a cost of £744 (Electric Vehicle Committee please note). The surveyor of taxes made an assessment of the electricity undertaking of £4,201 in respect of excess-profits tax for the year ended March 31st, 1915. Objection was successfully taken on behalf of the Council to the assessment, which has been discharged.

FULHAM.—The Electricity Committee reports that difficulties have been experienced with the economisers at the electricity works, due to tube failures under pressure, and it is proposed to work the economisers at atmospheric pressure, involving the

installation of a centrifugal pump to pass the water through the economisers to a galvanised hot well. The cost will be about £100, and will obviate an immediate expenditure of some £2,000 for renewals. The Committee has received the certificate of the Ministry of Munitions in respect of the borough electricity works, and has adjusted the wages of the employés in accordance with the scale approved by the Islington B.C. in connection with the certification of its electricity undertaking.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing by the Woolwich B.C. of £2,442 for electricity purposes.

The Committee, with the consent of the Treasury, has granted a loan of £3,000 to the Hackney B.C. for mains and switchgear.

ST. PANCRAS.—The Electricity Committee has decided in favour of an offer by the Brush Co. to remodel the 1,000-KW. Ljungstrom turbine, which the Council has had in satisfactory use for some time on hire, pending the installation of a 5,000-KW. set of the same type. It is proposed to alter it so that it will develop 1,500 KW. continuously and have an overload capacity of 20 per cent. for two hours, at a cost of £6,500, less £1,500 paid for hire.

A deputation of cinema proprietors has interviewed the Committee with a view to obtaining power rates for projector use. At present a special flat rate of 3d. per unit is given, and the Committee considers that such energy should be charged for at lighting, not power, rates.

Manchester.—A deputation appointed to consider the possibilities of increased street lighting, after visiting a number of other towns, has come to the conclusion that Manchester already has a larger proportion of lamps lighted than the towns visited.

Stafford.—LOAN SANCTION.—The T.C. has received sanction to a loan of £1,000 for the provision of new cable.

Stowmarket.—According to the *Bury and Norwich Post*, the Suffolk Electric Supply and Power Co. does not intend to increase the price of electricity for lighting and power, although the six months' working, April to September, showed a loss; the returns for the past three months, however, are satisfactory, and there is every prospect of this improvement continuing. The Summer Time Act accounts for the adverse balance during the spring and summer quarters.

Tonbridge.—At a meeting of the U.D.C., strong objection was taken to the application of the local gas company for a prov. order to supply gas for the purpose of generating electricity, in rivalry to the Council's electricity undertaking. A letter from the manager of the company expressed the opinion that they would be able to meet the Council on the matter, and the subject was deferred.

U.S.A.—According to the *Electrical World*, the Secretary of War, on the ground that he lacks legal authority, has refused to take action in regard to authorising additional water diversion at Niagara, but recommends that temporary permits be given to generate more power, and that this should be decided by Congress.

Willesden.—PROPOSED EXTENSIONS.—A report from the electrical engineer shows that, owing to the growth of the undertaking, the demand leaves no margin of safety or capacity in either cables or machinery, and extensions must be made before next winter. Application is to be made to the L.G.B. to sanction the borrowing of £10,110, made up as follows:—New 500-KW. rotary converter with transformers, switchgear, foundations, and connections at Salusbury Road and Acton Lane sub-stations, £3,600; new 1,000-KW. cable from Taylor's Lane to Acton Lane sub-station, with switchgear, £2,900; new 700-KW. cable from Taylor's Lane to Anson Road, £3,350; and other items. From April 1st to December 31st last, 61 services were laid at customers' expense, amounting to £486. Having considered a report on negotiations for inter-linking and inter-working of electricity undertakings in the metropolitan area, and in view of the fact that the agreement entered into by the Council with the North Metropolitan Electric Power Supply Co. expires on March 31st, 1918, the electrical engineer has been authorised to make inquiries in connection with the situation.

TRAMWAY and RAILWAY NOTES.

Australia.—Recently one person was killed and 20 were injured by an electric car overturning at Burwood, near Sydney. The car carried 40 passengers.

The Melbourne Tramways and Omnibus Co. has been awarded £335,000 as compensation in connection with the transfer of the Melbourne Tramways to the Tramways Board.

Blackburn.—FEMALE LABOUR.—The employment of females by the tramway department is said to have proved a pronounced success; a corresponding clerk, ticket clerk, two girls in the ticket stores, two inspectors, five drivers, and about 40 women conductors are employed, and others are learning to drive or receiving instruction as conductors.

Bury.—The Tramways Committee has had complaints as to the car service, and the manager explained that he had great difficulty in obtaining materials for repairs and renewals. An application has been received from the Tramway and Vehicle Workers' Association for an increase in the wages of female employés, and a Sub-Committee is to meet a deputation from the Association on the matter.

Continental.—SPAIN.—It is announced that the Spanish Minister of Public Works has just approved a scheme submitted by the city of Madrid for the construction of a metropolitan railway according to the designs prepared by D. M. Otamendi. The project, for which a concession has been granted for 90 years without any State guarantee or subsidy, comprises four lines, which are to connect the capital with the suburbs, and run from the north to the south and the east to the west. The lines are to be of double track and for electric traction; the first is to be completed in three years and the others in eight years from the stipulated date.

ITALY.—An agreement has been come to between the Italian Government and the Rome-Nord Tramways Co. for the construction and working of an electric railway from Rome to Viterbo, through Civitacastellana.

Halifax.—A heavy motor wagon collided with a tramway standard, last week, with such violence that the arm carrying the wires was smashed off entirely, and the live trolley wires fell over a length of road. A woman had her legs entangled, and received a shock from which she did not recover for several hours. The driver of a car, who was able to approach fairly closely, warned people of the danger, cut off the current, and notified the repair department. The tramway service was suspended for several hours during temporary repairs.

Haslingden.—TRAFFIC DATA.—During the nine months ended December 31st, the car-mile receipts of Haslingden tramways averaged 13·71d., as compared with 13·36d. for the same period of 1915, the total receipts being £6,559, as compared with £6,454. The mileage was 112,553, as compared with 113,644 in the nine months ended December, 1915. During the three months of October, November, and December, 1916, the car-mile receipts averaged 13·98d., as compared with 12·32d. in the same months of 1915. A reduction of car-mileage occurred, the figures for 1916 being 35,808 and those for 1915, 37,541.

Huddersfield.—WAGES.—The Tramways Committee has granted an increase of 3s. per week in the bonus of male employés under the Union (excluding office staff), as from November 22nd, 1916, and a bonus of 1s. 6d. per week to the female employés (excluding office staff), from the same date.

The Committee has decided to charge for the carrying of parcels on the cars, 1d. up to 5 lb.; 2d., 14 lb.; 3d., 28 lb.; and that no parcel above 28 lb. be carried. It was further resolved that no parcels be carried after 5 p.m.

London.—An unprecedented stoppage of electric railway services on London suburban routes took place on Monday morning, when, owing to sleet having frozen on to the conductor rails, most of the exposed sections of such railways using the third-rail system were unable to run until the ice was thawed or broken off. The District, Metropolitan, South-Western, and North London Railways were particularly affected, and in some cases steam locomotives were requisitioned to haul the disabled electrics home, and steam trains ran a relief service. Attempts to scrape off the ice did not always succeed, and in some cases a hammer was required. The weather conditions as applying to electric railway working are stated to have been the worst which have been experienced since the lines were electrified.

L.C.C.—The Highways Committee reports that for the five weeks ended January 10th the total number of passengers carried on the Council's tramways was 53,160,172, giving a revenue of £221,279, as against 54,291,778 and £228,425 in the previous year; this represents a decrease of 1,131,606 passengers and £7,146 in revenue. The total traffic receipts from April 1st, 1916, to January 10th, 1917, were £1,951,183, an increase over the previous year of £147,109.

At the Tuesday meeting of the Council, it was stated that there had been 50 breakdowns in the tramway service between January 1st and Friday last. Mr. Hume, the chairman of the Highways Committee, in pointing out the difficulties which had occurred owing to the war, stated that they hoped by internal reorganisation to be able to effect an improvement, and a scheme would shortly be submitted which, though it would involve some cost to the Council, he hoped would be supported.

Stockport.—STRIKE.—Practically the whole of the employés on the Corporation tramways struck work on Saturday morning, and the service was suspended during the day. The employés were included in the recent award of Sir George Askwith, and the fact that the women workers were not included in the award was one of the causes of the strike. It is contended that they only earn 31s. 6d. on the full week, as against £2 by the men. The men also had a grievance that a former advance of ½d. per hour had been discontinued, and that by the late cars being discontinued, their wages will be further reduced. The management's reply is that the late cars are being taken off because they have been run at a loss, and it is contended that the ½d. referred to is included in the war bonus. Between 400 and 500 employés were concerned.

As a result of negotiation, the ordinary car service was resumed on Sunday. The men have been given a 52-hour week, and the question of the women's war bonus will probably be considered throughout Lancashire.

West Ham.—The tramway manager (Mr. Slattery), with a view to expediting the reconstruction of cars, has suggested the purchase of car bodies completed ready for mounting, and tenders for 20 such bodies are to be obtained.

The through service from Stratford to Chingford Mount is to be discontinued, and a service between Baker's Arms and the Docks, *viâ* Stratford, instituted.

TELEGRAPH and TELEPHONE NOTES.

Cable Rates to the Dominions.—It is rumoured that the Report of the Dominions Royal Commission, which will shortly be issued, will contain recommendations for drastic changes in connection with the charges for telegrams to the British Dominions.

G.W. Railway.—Included in the work of the Signal Department of the Great Western Railway during the past year was the laying of 5¼ miles of air-space core telegraph cable; in 1915 6¼ miles were laid.

High-Speed Telegraphy.—The Committee appointed by the Postmaster-General at the end of 1913 to examine the various systems of high-speed telegraphy has just issued its report. The main conclusions arrived at are: That systems on the multiplex principle are definitely superior to the automatic high-speed systems on the large majority of main circuits for ordinary inland commercial telegraph work; the extension of systematic Wheatstone working should be discontinued; the Western Electric having yielded the best results, seven or eight quadruple duplex installations should be ordered; the five-unit alphabet as a code for printing telegraphy is better than the Morse code, leaving out of account news traffic and submarine cable communications.—*Daily News.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—SYDNEY.—Feb. 19th. Municipal Council. Meters, maximum-demand indicators, feeder regulators. Specification from E.L. Department, Town Hall.

March 5th. Council. One 7,500-K.V.A. turbo-alternator. See "Official Notices" January 5th.

ADELAIDE.—March 28th. P.M.G.'s Department. Telephones, telephone parts, line and battery material, &c. Shedules 444 to 453.—*Australian Mining Standard.*

MELBOURNE.—March 21st. Victorian Railways. Half-watt lamps and lanterns—*Australian Mining Standard.*

Banbridge.—February 3rd. Urban Council. Public lighting of the district with gas or electricity.

Bedford.—Electricity Department. Extensions, comprising buildings, boiler-house plant, turbo-generator, steam and water auxiliaries, switchgear, &c. See "Official Notices" January 19th.

Cheltenham.—February 14th. Corporation. Twelve months' supply of electric light fittings. Mr. J. S. Pickering, Borough Engineer.

Halifax.—February 12th. Corporation Tramways Committee. Stores and materials, including lighting materials, wheel brake blocks, trolley and overhead line materials, &c., for twelve months. Tenders to Tramway Engineer,

Keighley.—February 24th. Keighley and Bingley Joint Hospital Board. Electrical work at the Morton Banks Sanatorium. Mr. J. N. Clarkson, Clerk, 40, North Street.

London.—BATTERSEA.—February 6th. Electricity Department. Oils, engine-room stores, meters, joint boxes, &c. See "Official Notices" January 19th.

BERMONDSEY.—February 22nd. B. of G. Three, six and twelve months' supply of electric lamps. Mr. E. Pitts Fenton, Clerk, 283, Tooley Street, S.E.

Manchester.—February 2nd. Electricity Committee. Cooling towers. See "Official Notices" January 19th.

February 13th. Corporation Tramways Committee. Stores. See "Official Notices" to-day.

Middlesbrough.—February 1st. Corporation. Twelve months' supply of electric lamps. Mr. S. E. Burgess, Borough Engineer.

Portsmouth.—February 6th. Tramways Committee. Six months' supply of stores, including several electrical items. See "Official Notices" to-day.

New Malden.—January 31st. Malden and Coombe U.D.C. Installation of fire-alarm system. Particulars from the Council's Engineer.

South Africa.—DURBAN.—February 12th. Six four-ton electric travelling portable jib-cranes for the harbour.*

March 8th. Department of Post and Telegraphs. Installation of an automatic telephone exchange at Pietermaritzburg. See "Official Notices" January 19th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Department in London.

CLOSED.

Government Contracts.—List of new contracts placed during December, 1916:—

WAR OFFICE.

Distributing boards.—Dorman & Smith, Ltd.
Ebonite rod and sheet.—British Ebonite Co., Ltd.
Motor-driven fans and accessories.—J. Keith & Blackman Co., Ltd.; Sturtevant Engineering Co., Ltd.
Electric light fittings.—Barton & Sons, Ltd.; Cable Accessories Co., Ltd.; Electrical Conduits, Ltd.; Eureka Conduits & Fittings Co.; General Electric Co., Ltd.; Ingram & Kemp, Ltd.; Nettlefold & Sons, Ltd.; Oriental Tube Co., Ltd.; Perfecta Seamless Steel Tube & Conduit Co., Ltd.; Rainsford & Lynes, Ltd.; G. Roe & Sons; T. Saveker; Simplex Conduits, Ltd.; C. J. Thursfield & Co., Ltd.; Veritys, Ltd.; Walsall Hardware Mfg. Co.; Ward & Goldstone.
Generating sets.—Aster Engineering Co., Ltd.; Austin Motor Co. (1914), Ltd.; A. Lyon & Wrench.
Switchboards and dynamos.—Dorman & Smith, Ltd.; Lancashire Dynamo and Motor Co., Ltd.
Switches.—Sperryn & Co., Ltd.; J. H. Tucker & Co.
Electric wire.—British Insulated & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; I. Frankenburg & Sons, Ltd.; Fuller's Wire & Cable Co., Ltd.; W. T. Glover & Co., Ltd.; A. Green, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; Liverpool Electric Cable Co., Ltd.; Midland Electric Wire Co., Ltd.
Works services.—Electric lighting at Lympne: H. J. Cash & Co., Ltd. Electric lighting at Thetford: Tredegars, Ltd. Electric lighting at Turnhouse: Allan, Arthur & Ure.

INDIA OFFICE STORE DEPARTMENT.

Transmitters.—Siemens Bros. & Co., Ltd.

POST OFFICE.

Repairing wire apparatus.—Wynn, Timmins & Co., Ltd.
Telegraph apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.
Tubular telegraph-pole arms.—Bullers, Ltd.
Submarine cable.—Telegraph Construction & Maintenance Co., Ltd.
Telegraph cable.—Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Siemens Bros. & Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Galvanometers.—Edison Swan Electric Co., Ltd.; W. G. Pye & Co.
Plates for stay-rods.—Bayliss, Jones & Bayliss.
Cable distribution plugs.—B.I. & Helsby Cables, Ltd.
Stay-rods.—Bayliss, Jones & Bayliss, Ltd.
Suspenders for cable.—P. Huntingdon & Co.
Bronze wire.—T. Bolton & Sons, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—B.I. & Helsby Cables, Ltd.

Ireland.—NEWCASTLE WEST.—The Newcastle West Commissioners have decided to accept the tender of Mr. Wm. Phelan, managing director of Newcastle West Electric Light Co., for lighting the town.—*Freeman's Journal.*

London.—L.C.C.—The Highways Committee has received the following tenders for alterations and additions to switchgear in connection with the third new turbo-generator to be installed at Greenwich generating station:—

Ferguson, Pailin & Co., Ltd.	(accepted)	£2,444
British Westinghouse E. & M. Co., Ltd.		5,256
British Thomson-Houston Co., Ltd...		5,519

For additional steam, exhaust and condensing water piping, &c., required in connection with the new turbo-generator:—

Brightside Foundry & Eng. Co., Ltd.		£5,527
Babcock & Wilcox, Ltd.	(incomplete)	5,943
J. Spencer, Ltd.		7,055

The tender of the Brightside Foundry & Engineering Co., Ltd., has been accepted, plus £140 for thicker plates for the large circulating water pipes, and £235 for steam pipes with riveted flanges and for valves of a type different from the type originally specified.

Mechanical stokers for four water-tube Stirling boilers at Greenwich generating station, to render them suitable for burning coke or low-grade coal:—

Underfeed Stoker Co., Ltd...	(accepted)	£5,447
E. Bennis & Co., Ltd.		5,945

The Stores and Contracts Committee has accepted the following tenders during the three months ended December 31st, 1916:—

Electric insulating material, Schedule No. 15 (40 firms invited to tender).—L. Andrew & Co. (items 2 and 9); R. W. Blackwell & Co., Ltd. (items 1, 6 and 7); G. Hattersley & Sons (item 10); Hooper's Telegraph and India-Rubber Works, Ltd. (item 8); G. MacLellan & Co. (item 3); Siemens Bros. & Co., Ltd. (items 4 and 5).
Electric lamps, Schedule No. 17 (15 firms invited to tender).—Maxim Lamp Works, Ltd. (items 1 to 7); Pope's Electric Lamp Co., Ltd. (items 8 to 27), estimated value £2,472 (metallic-filament lamps with filaments of drawn wire in one continuous length); Cryselco, Ltd. (items 8 to 27) (metallic-filament lamps with filament not of drawn wire), estimated value £2,538.
Electric lamps, Schedule No. 17 D (11 firms invited to tender).—Maxim Lamp Works, Ltd. (item 2), estimated value £3,437.

The Committee calls attention to the fact that of the eight firms who submitted tenders for electric traction lamps, seven quoted the same price and discount.

The Stores and Contracts Committee has arranged for the supply from various firms during the year 1917 of electric fittings and engine packings subject to current discount rates on catalogue prices, and for the supply of wrought-iron tubing until February 10th, 1917, at discounts off the standard list.

BOARD OF TRADE.—The Board of Trade has placed with Messrs. W. C. Tackley & Co., Ltd., of West Kensington, the contract for the entire installation of electric lighting for the British Industries Fair, which opens next month. The contract includes, for the stands for the two buildings—the Victoria and Albert Museum and the Imperial Institute—between 2,000 and 3,000 lights (25 and 32 C.P.). Supply is obtained from separate mains taken into both buildings by the Office of Works, and aerial wires are carried well over the top of the stands. The work is well in hand already. Messrs. Tackley will have a stand at the Fair.

Rawtenstall.—The tender of Messrs. Jones Bros., of Manchester, has been accepted for the lighting by elec ty of a portion of Bury Road.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, January 26th. At 5 p.m. At the Imperial College of Science and Technology, South Kensington, S.W. General meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, January 30th. At 7.30 p.m. At the Engineers' Club. Paper on "Fuel Economy," by Mr. J. Drummond Paton and Mr. J. Frith.

Royal Society of Arts.—Tuesday, January 30th. At 4.30 p.m. At John Street, Adelphi, W.C. Lecture on "Imperial Industries After the War," by Mr. O. C. Beale.

Chemical Society.—Thursday, February 1st. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary scientific meeting.

Royal Institution of Great Britain.—Thursday, February 1st. At 3 p.m. At Albemarle Street, Piccadilly, W. Lecture on "The Mechanism of Chemical Change," by Prof. F. G. Donnan, F.R.S.

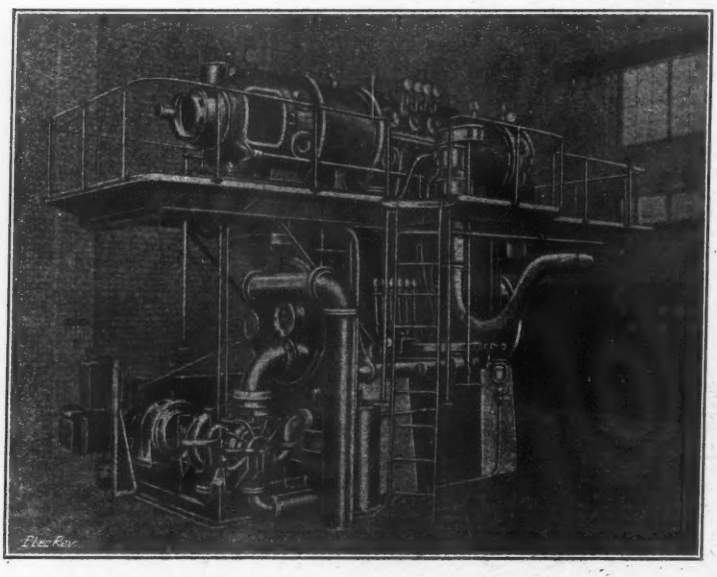
Friday, February 2nd. At 5.30 p.m. At Albemarle Street, W. Lecture on "The Supply of Gaseous Energy," by Dr. C. Carpenter.

NOTES.

Electrical Steel in France.—It is announced that the Société Paul Girod, which utilises the water power in the valley of the Arly at Ugine, has brought into operation a new electric steel furnace of 10 tons capacity. This will enable the production of electric steel to be increased to 150 tons per day.

Trade with Russia.—An important scheme for the promotion of closer commercial and educational relations between Glasgow and Russia was inaugurated at a public meeting in Glasgow, last week, convened by the Lord Provost. It was explained that Mr. William Weir, Director of Munitions for Scotland, had endowed for five years a lectureship in Russian at Glasgow University, and that Messrs. Brown and Messrs. Denny, shipbuilders, had promised a sum for five years for a Russian travelling scholarship. The Lord Provost appealed for £50,000. A fine response resulted.—*Daily Telegraph.*

Self-contained Turbo Sets.—In our issue of November 24th last, in discussing some aspects of power-station design, we referred to the apparent desirability of revising our ideas of engine-house design, in view of the evolution of types of generating plant which differ so essentially in constructional and operating characteristics from the plant types of the past. In the old days the bulk of the running plant demanding supervision was above the engine-room floor; nowadays the plant in the basement requires the most attention, the condensing plant being all-essential to efficient operation.



Self-Contained Turbo-Condenser Set.

It was suggested that, in view of tendencies in plant design, the most efficient arrangement would be to make the present basement floor the starting point for engine-room structures and to develop self-contained turbo-condenser plant, which, in addition to involving less costly buildings, would facilitate supervision of the running of the whole plant. Our view shows a turbine set of this type in a Continental power station.

Cable Makers' Association.—We are notified by the secretary of the Cable Makers' Association that they have left No. 64, Victoria Street, Westminster, S.W., and taken new offices at Sardinia House, Sardinia Street, Kingsway, London, W.C., to which address in future all communications should be sent.

Electric Starting Sets on Motor Cars.—One of the most noteworthy differences between American and British motor-car construction is the way in which electric engine-starting devices have been adopted as a standard fitting on the cars turned out on the other side of the Atlantic. While in this country but few car manufacturers have adopted such installations as standard, We note from a list of 181 different models of cars published lately in an American contemporary that no fewer than 177—that is, all but four—are provided with an electric engine starter.

L.C.C.—The Finance Committee reports to the Council that it has decided that, until further order, the rate of interest to be charged by the Council for loans to local authorities shall be 5½ per cent.

The Stores and Contracts Committee reports having made inquiries with regard to a number of firms who were suspected to be controlled wholly or largely by enemy aliens, and, as a result, has removed the names of three firms from the Council's lists of firms to be invited to tender for the supply of stores, &c.

A Vital British Industry.—The perfection of the high-speed internal-combustion engine, which began with the introduction of the motor-car 21 years ago, has re-modelled our methods of traction, and, at the same time, created a vast industry, with a large number of contributory trades more or less dependent on it. Among the most important of these may be classed the manufacture of magnetos. When war broke out there was only one British firm making magnetos, its output being under a 100 a week. Practically every magneto which went on to the motor vehicles, motor boats, and aircraft of Great Britain came from enemy Germany or from America. Till August, 1914, we had been content to go abroad for nearly all our magnetos.

But in a few short months British manufacturers got steadily to work. Some of the best scientific brains in this country were enlisted. New and special steels and other materials were evolved. To-day there are some 12 or more British firms making magnetos. Their entire outputs, reaching a total to date of over 165,000 magnetos, have been made for war purposes, and are used on aeroplanes, seaplanes, airships, motor lorries, motor ambulances, motor cycles, "tanks," big gun tractors, motor boats, wireless sets, searchlight sets, lighting sets, &c. In fact, it may be said that the war is being conducted on British-made magnetos.

After the war the resources of the British magneto manufacturers will be at the disposal of the British public. There will be no need to buy enemy or other foreign magnetos.

Lighting Restrictions in France.—As was mentioned in a previous issue, the French Government has published decrees for the purpose of bringing about a reduction in the consumption of gas and electricity for lighting. In the first place, Article 1 of the decree of November 21st, 1916, provides that no new contract may be entered into or an increase made in any existing contract without the authority of the Ministry of War in the case of all distributing networks which supply either State establishments or private establishments and works which are occupied on work for the national defence. The decree was brought into force on December 19th, when the electricity supply undertakings concerned were specified as comprising (1) all those for the sale or distribution of energy whose generating stations have a total power installed which is equal to or greater than 500 KW., and (2) the companies which purchase from generating undertakings which are subject to the regulations of the decree, the whole or a portion of the energy which they resell. Lighting applications for less than 5 hectowatts, and those for power for less than 1 KW., however, can be satisfied by the companies in question without the advice of the military authority.

A further decree has been promulgated by the Ministry for the Interior in regard to the consumption of energy by lighting customers. According to this measure the maximum consumption of each user has been fixed on the basis of the actual consumption either in 1913 or 1915, but the total consumption cannot exceed 80 per cent. of the basis consumption. The latter was modified at the end of December, so that the permissive maximum daily consumption per person residing with the consumer is now 3½ hectowatts for a consumer who formerly used 5 hectowatts; 4 hectowatts as compared with 7 hectowatts previously, 4½ hectowatts as against 9 hectowatts, and 5 hectowatts as contrasted with 11 hectowatts formerly. In those cases where the consumption was over 11 hectowatts the daily consumption has been fixed at 5 hectowatts, plus one-sixth of the proportion of the basis consumption higher than 11 hectowatts. A variation of 10 per cent. is allowed.

Inventions for the Admiralty.—The Admiralty has issued a notice reminding the public that correspondence on naval matters should not be addressed direct to individual members of the Board of Admiralty, but in the case of inventions to the Secretary, Board of Invention and Research, Victory House, Cockspur Street, S.W., and, in all other cases, to the Secretary of the Admiralty.

Metropolitan Association of Electric Tramway Managers.—A meeting of the members of this Association was held at the Municipal and County Club, Whitehall Court, Whitehall, S.W., on Friday, the 19th inst., when there were present:—Messrs. Ullmann (East Ham), chairman, Hammond (M.E.T.), vice-chairman, Bruce (L.C.C.), Schofield (Leyton), Harvey (Ilford), Slattery (West Ham), Mason (South Met.), Mackinnon (London United), and Goodyer (Croydon), hon. sec. Letters notifying inability to attend were received from Messrs. Stokes (Bexley Heath), Williams (Erith), and Murray (Walthamstow). Various matters of interest were discussed.

"Sterling" British Products.—While the Sterling Telephone and Electric Co., Ltd., has been busily engaged almost from the commencement of the war on work of national importance, the fact that until recently it had not been able to shake off wholly the trammels of its earlier associations no doubt detracted somewhat from the satisfaction of the management and staff. Hence, we suppose, it was felt that the purchase of all the enemy shares from the Public Trustee by Sir John Bethell and his friends, announced in our last issue, and the changes in the directorate, called for a special celebration, which, in accordance with British custom, took the form of a dinner, at which the staff and a few friends were the guests, about 120 in all, of the chairman and directors of the company. Sir John Bethell, Bart., M.P., presided, and was supported by Mr. Guy Burney (managing director) and Mrs. Burney, Sir Thos. Bethell, Mr. C. S. Syrett, and Mr. L. A. McGeoch.

After the loyal toast had been duly honoured, and the chairman had proposed "H.M. Forces," Mr. Burney proposed "The Staff," expressing his cordial appreciation of the magnificent work they had accomplished since the outbreak of war; before that event the company employed in all 300 persons—now, at Dagenham alone, their workpeople numbered over 1,400. He made special mention of the services of Mr. Sherwood, his right-hand man from the beginning, 16 years ago; Mr. Bell, with a record of 14 years of invention in telephone and signalling systems; and several other members of the staff, including ladies, who had been with the firm for 8 to 16 years. Many of their former colleagues were serving with the Forces—all by choice and not under compulsion—and happily there had not been one fatal casualty among them; their positions were kept open, and they would be welcomed on their return. He wished for closer contact between the staff and the workpeople, and to that end hoped soon to erect a club house near the works, on a site of 5½ acres, the whole of which would be available for recreation. Mr. Burney concluded by urging his hearers to be provident while they were prosperous, for, while he had every confidence in the future of the company, there might be a period of reaction for which they should provide in time.

In reply, Mr. Sherwood referred to the strong support and encouragement received from Mr. Burney by the staff, who had all worked together with the greatest goodwill, and Mr. Janes pointed out that their success was largely due to Mr. Burney's gigantic efforts to secure contracts and machinery.

Proposing "The Directors," Mr. Bell referred to their excellent qualifications for their office, and said they were a board that any body of men should be proud to serve. Mr. McGeoch, in reply, mentioned that he had for 17 years been associated with Mr. Burney, and endorsed a remark of Mr. Bell's that good material and the best workmanship should be the hall-mark of British manufactures in the trying times to come. Mr. W. J. Hammond proposed "The Ladies," and Mrs. Parrett, the supervisor of the welfare department, responded in an excellent speech, in the course of which she paid a tribute to Mrs. Burney as a real true friend to all the women workers.

In proposing the health of the managing director, Mr. F. S. Hooker dwelt on the indomitable courage and energy with which Mr. Burney had overcome innumerable difficulties, and had brought the company into its present strong position; his relations with the staff had been most cordial, and as a token of their appreciation of the way in which he had governed them, they wished to present him with a Cromwellian clock and an illuminated address. The toast was accorded musical honours, and Mr. Burney expressed his heartfelt thanks for these marks of their esteem, with which he was highly gratified. Afterwards reviewing the history of the company from its earliest days, he described how in 1902 he had placed on the market the first successful multiple-lever automatic interphone, of which enormous numbers had been sold. The Dagenham works were started in 1910, the whole of the staff being British from the commencement; they were getting on nicely until the outbreak of war put an end to their industrial activities. However, large contracts were obtained, which had amply compensated for the diminution of their ordinary business.

Mr. Burney then proposed "The Visitors," coupling with the toast the name of his first customer, Alderman Duncan Watson, who, in reply, expressed his continued satisfaction, over a period of 17 years, with the company's products; he regarded the example of the Sterling Co. as one that should be copied by every firm in the country. Mr. S. R. Worley, proposing "Prosperity to the Firm," expressed his admiration of the organisation of the company's works and of the care displayed for the comfort and happiness of the employés, and Sir John Bethell, in reply, stated that the establishment was the best organised of all that he had inspected; only housing accommodation was lacking, and that problem would have to be solved in the near future. The proceedings were enlivened by an excellent programme of music, &c. In spite of the restrictions imposed by war conditions, the occasion was a marked success in every way, and made an admirable start for the new *régime*.

Institution and Lecture Notes.—Belfast Engineers' Association.—On Friday evening last, a paper by Mr. C. G. Major, entitled "Electric Lifts on Land and Shipboard," was read by Mr. P. H. Stevens. The paper dealt largely with the mechanical side of the subject. *Re* marine lifts, the author said that all the features of land lifts must be repeated, with additions. The pitching and rolling of a ship would demand stronger fixings for the winding engine, and this was still more true of all portions at the head of the lift well. The guides, in a cross sea, with the cage and balance-weight trying to swing as pendulums, would be subjected to serious cross stresses, and must not only be stiffer in action, but more firmly secured. Yet it must be remembered that no ship was absolutely rigid in heavy seas, and if no flexibility in fixing was provided, something must go. The swinging control cables below the cage were generally voted a nuisance, but the only alternatives were bare live conductors, as in a crane, or a weighted and guided pulley running in the bight of the bundle of cables. The first was clearly out of the question, and the second broke up the cables and set up dangerous short circuits. But if the fittings inside the well were so formed that the free-swinging bight could not catch beneath them when rising, there need be no trouble. All switches should be made hose-proof, and the motor and controller should be housed on a lower deck and properly protected from sea wash. The brake should be modified so that when free for running, with the ship rolling, the chocks should not be able to hammer the wheel.

Association of Mining Electrical Engineers.—At a meeting of the West of Scotland Branch, in Glasgow, on the 20th inst., Mr. H. A. M'Gubbie, convener of the Bell Signalling Committee, introduced a demonstration with mining signals and bells to comply with the new regulations set up by the Home Office. Various systems of sparkless signalling for underground use were tested and explained, including the Davis-Macdonald solenoid bell arrangement, a device fitted by the Sterling Telephone Co., the Davis-Railing patent relay, which has been introduced by the General Electric Co., the "Wigan" bell and relay supplied by Messrs. Heyes & Co., and Prof. Thornton's device for testing the efficiency of existing bells and relays. At an interval in the proceedings, a paper on "Modern Switch and Fuse Gear" was read by Mr. Alex. M'Phail (Kilmarnock).

Electric Power and the Output of Boots.—At Northampton Tribunal, on Tuesday, the Northampton Electric Light and Power Co., Ltd., appealed for the exemption of Alfred Hutchings, aged 29 (married), an electrician, wireman, and motor inspector, passed for Class B1, and William Trusler, 39 (married), general labourer, passed for Class A. A representative of the firm said the labourer was employed on the work of the new generating station, which was urgently required for the production of electricity for industrial purposes. The work was certified Class A, and was being carried out with the sanction of the Government. The Chairman: So far as the demand for current for industrial purposes goes, that will go down a great deal owing to men being taken from the boot factories. The Representative: It is not making any difference to our output, which is going up. Is not the tendency rather to replace men by machines, and so increase the demand for power? Mr. Gribble (a member of the Tribunal): That is certainly the logical conclusion. The Tribunal gave three months' exemption, with V.T.C. conditions in each case, and the military representative said he would have to appeal from the decision so far as it concerned Hutchings.

New American Electric Passenger Car.—The Milburn Wagon Co., of Toledo, Ohio, has introduced a new type of town passenger "electric," which appears to mark a considerable advance in this type of vehicle. The car seats four passengers in the enclosed body, and another one with the driver on the driver's seat. It has a wheel base of 105 in., and total length of 146 in.; it is equipped with a G.E. motor and controller, and wire wheels with 4-in. tires. The car speed is from 6 to 25 miles an hour, and the travelling radius is 60 to 80 miles with lead batteries (Philadelphia), or 70 to 90 miles on Edison batteries.

Moscow's Proposed New Electrical Station.—The responsible agent of the Belgian Central Electrical Station Co., of Moscow, D. P. Rotzoff, has announced in Belgium the refusal of the Town Council to return to the company its cash deposit for the concession to construct a second electrical station in Moscow. The Town Administration, without waiting for a claim from the company, is arranging to turn the deposit over to the town funds, and to use the piece of land purchased in the name of the town for the construction of a station. It is not believed in the Town Administration that the Belgian company will make any claim for the return of the deposit. Not only are the hopes of winning such claim very small, but there are other obstacles as well. In order to initiate such a claim, it would be necessary to deposit over 50,000 roubles in legal dues, and the company hardly possesses sufficient funds to do this.

Reversal of Rotation of Three-phase Motors.—Under certain conditions, when one phase of a three-phase distribution system is interrupted, the motors connected to the system may begin to rotate backwards. An instance reported by the *E.T.Z.* occurred on the system supplied by the Hoechst electricity works last year. Owing to the fracture of an insulator on the occurrence of a short-circuit, an oil-switch failed to close one of the phases, and the motors in a number of works started up in the wrong direction.

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters, Balderton Street, Oxford Street.—Orders for the week, by Lieut.-Col. C. B. Clay, V.D., Commanding :—

Monday, January 29th.—Technical for Platoon No. 9, at Regency Street. Squad and Platoon Drill, Platoon No. 10. Signalling Class. Recruits' Drill. 6.30—8.

Tuesday, January 30th.—A volunteer fatigue party is required to assist the Quartermaster.

Wednesday, January 31st.—Instructional Class, 6.15. Platoon Drill, Platoon No. 1.

Thursday, February 1st.—Platoon Drill, Platoon Nos. 5 and 6. Ambulance Class by M.O., 6.30.

Friday, February 2nd.—Technical for Platoon No. 10, Regency Street. Squad and Platoon Drill, No. 9. Signalling Class. Recruits' Drill, 6.25—8.25.

Saturday, February 3rd.—Commanding Officers' Parade, 2.45. Uniform.

Sunday, February 4th.—Entrenching at Otford. Parade Victoria (S.E. & C. Railway Booking Office), 8.45 a.m.

(By order), MACLEOD YEARSLEY, *Adjutant.*

Trade Union "Discipline."—Mr. H. W. Thornton, general manager of the Great Eastern Railway, in a recent speech spoke of the lack of discipline in British Trade Unionism. According to the *Times*, he said it was nothing more or less than a pest. "He and his colleagues had frequently come to an understanding with the representatives of the men on some particular question, only to find that when the representatives went back to their constituents the whole thing was upset. If British Trade Unionism was to get on, and was to earn the confidence of employers, it must look to its internal discipline, and see that when a bargain was made by the leaders of a Union that bargain was adhered to by all the members of the Union as faithfully as it was adhered to by the employer."

Re Cedes Electric Traction, Ltd.—In the Winding-up Court, on Wednesday, Mr. Justice Astbury decided to postpone for six months an order for the compulsory winding up of this company, in order to enable the Board of Trade to decide whether it should exercise its powers under the Trading with the Enemy Act. The application was made by an English creditor. The winding-up order was made last April. It was stated that there were a number of unsecured English creditors, but that an enemy creditor now claimed a sum which, if admitted as a debt, would swamp the assets so far as the English creditors were concerned.

Prohibited Exports.—A Supplement to the *Board of Trade Journal*, of January 25th, contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from the Straits Settlements, Hong-Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana.

Technical Training for Disabled Sailors and Soldiers.—The Education Committee of the L.C.C., referring to the course of training to enable sailors and soldiers to qualify for employment as switchboard or sub-station attendants which has been established at the Northampton Polytechnic Institute, has considered the report of the Committee of the Institution of Electrical Engineers on the courses, and gives the following figures relating to the work accomplished in the three courses which have been held since the scheme commenced :—

	First course.	Second course.	Third course.
(*a*) No. of applicants for admission ...	22	21	22
(*b*) No. commencing the course ...	13	20	18
(*c*) No. approved for employment ...	15	14	—
(*d*) No. actually placed	13	12	—
(*e*) No. of applications from employers	16	42	over 50

The differences between the figures given under (*c*) and (*d*) are due to the fact that even at the end of the training, certain men were not ready to discontinue hospital treatment.

The increase in the number of applications from employers, and other evidence, such as the reports from employers on the work of those who passed through the course, seem to indicate that the course has been well planned, and that the men are being enabled to earn their own living.

New American Westinghouse Works.—According to the *Electrical World*, arrangements have been made by the Westinghouse Electric and Manufacturing Co. to construct a large factory on the Delaware River at Essington, Pa., not far from Philadelphia. The land has a deep water frontage, and provides sufficient area for a factory development several times as large as the East Pittsburg works ; it is reported that the new plant will cost between 5 and 7 million dollars, and employ 15,000 men.

Appointments Vacant.—Shift engineer, for Colchester electricity supply department ; temporary charge engineer (£3), for the Borough of Southwark electricity department. See our advertisement pages to-day.

Cornish Tungsten.—Steps have been taken to press on the working of the wolframite deposits on the Duchy of Cornwall estates at Hingston Down and Kit Hill ; new machinery has been erected, and it is understood that good progress has been made. Fine lodes of ore have been discovered, and it is the opinion of experts that in the future Cornwall will be able to produce a large proportion of the wolfram required in this country.—*The Times.*

Removing Drilling Tools from Oil and Gas Wells.—According to a patent of Walter O. Snelling, of Pittsburg, Pa., drilling tools which have become broken and jammed in drilling wells may be removed by introducing a salt solution, lowering a copper bar until it makes contact with the iron drill, and then passing a current of 300 to 400 amperes through the electrolyte. The nascent oxygen formed corrodes the iron, and this corrosion may be carried so far as to completely consume the tools, or only partial corrosion may be carried on, when the tools become dislodged and may be fished out.—*Met. and Chem. Engineering.*

Consular Reform.—The recommendations of the Association of Chambers of Commerce as to the reform of the Consular Service have been heartily endorsed by the affiliated Chambers. The Association has received a letter from the Foreign Office stating that Lord Robert Cecil is prepared to receive a deputation, but suggesting that before a date is fixed the Council should study the report recently drawn up by a Foreign Office Committee respecting the proper organisation of the Government service of commercial intelligence in foreign countries. The Council of the Association has now expressed itself in agreement with the broad lines of this report.—*Daily Telegraph.*

The *Times* refers to the matter at some length in its issue of January 20th. The report to the Foreign Office is stated to be a confidential but very important one ; indeed, so revolutionary is it said to be that if the changes that it advises in the Consular Service are adopted, the position will be so altered that all recommendations will require to be reconsidered as a whole. The adoption of a general foreign trade policy is forecasted.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The General Purposes Committee of the L.C.C. report having granted leave of absence, owing to illness, for six months, if necessary, to Mr. A. L. C. FELL, the chief officer of tramways.

The Willesden Urban District Council has decided, in view of the progress of the electricity undertaking and the important duties discharged by Mr. BLAKE, that his salary, as from April 1st next, be increased from £400 to £500, and thence by two annual increments of £50 to £600.

West Ham Corporation has granted the following increases of salary, amongst others, in connection with the working at the electricity department, the figures being exclusive of war bonuses payable :—Mr. E. Tombs, stores manager, from £200 to £220; Mr. J. Layton, senior shift engineer, 70s. a week to 75s.; Mr. A. J. Giffin, ditto, 67s. 6d. to 72s. 6d.; Mr. W. Bridger, ditto, 65s. to 70s.; Mr. W. Spittle, ditto, 62s. 6d. to 67s. 6d.; Mr. W. J. Watson, mains foreman, £147 to £160; Mr. W. A. Wiggins, electricity collector, from £150 to £165, increasing after 12 months to £175.

Mr. WM. MILLS, Glasgow, has been appointed chief assistant at the Falkirk T.C. electricity works, at £150 per annum.

General.—Mr. S. E. BASTOW, who for the last four years has been joint manager of Bruce Peebles & Co., Ltd., Edinburgh, has accepted the position of chief engineer to British Dyes, Ltd. Mr. Bastow's headquarters will be at Huddersfield. Mr. JOHN H. BUNTING, who for the last four years has been joint manager of Bruce Peebles & Co., Ltd., has been appointed general manager of the company.

Mr. ETHELBERT RENDELL has been given a commission as Second-Lieutenant in the Tyne Electrical Engineers, R.E.

Ald. J. P. SMITH, J.P., who has been chairman of the Barrow Corporation Electricity Committee since its formation in 1897, has been admitted to the freedom and livery of the City of London in the Feltmakers' Company.

Mr. J. B. HAMILTON, the Leeds city commercial manager since 1914, and formerly tramway manager, has been appointed Director of Trades Regulations in the Admiralty department, now being organised by Mr. Lynden Macassey, K.C., for control of labour in shipyards and machine and boiler works. All the Leeds Corporation Committees have approved Mr. Hamilton's acceptance of the post, conditionally on his being available as necessity may arise. His salary will be paid by the Corporation, the Admiralty, as in the case of other municipal officials lent, bearing the expenses incidental to the appointment. As commercial manager of all municipal undertakings at Leeds, Mr. Hamilton has the direction of 8,000 workers.

Mr. THOMAS F. MAYLOR, who before the war was assistant chief inspector at Messrs. Dick, Kerr & Co.'s, Ltd., Preston, and who is now chief inspector at a large Government munition factory in the Metropolis, has been presented with a gold watch, subscribed for by the employés as a mark of esteem.

Roll of Honour.—We have received a copy of the latest Roll of Honour of Edmundsons' Electricity Corporation, Ltd., from which it appears that there are 404 men from the associated undertakings now serving with the Forces. Eighteen of the staff have made the supreme sacrifice. The D.S.M. has been gained by J. C. Knight, of the Frome undertaking; the D.C.M. by C. W. Saunders, of the Twickenham under-

taking; and the following have won the Military Medal:—V Johnson, of Godalming; J. Polkinghorne, of Hayle; and J. Summers, of Hamilton.

Lance-Corporal R. TONGE, Lancashire Fusiliers, previously reported missing, and now reported killed, was employed by the British Westinghouse Co., at Trafford Park.

Private J. MCLAUGHLIN, who has been killed in action in Mesopotamia, was employed by Messrs. Dick, Kerr & Co., Preston.

Captain HARRY RICHARDSON, R.E., has been "mentioned" for distinguished service at the Front. Captain Richardson, who is the general manager of the Dundee Corporation electricity department, has been at the Front with his unit for 18 months.

ALFRED H. ADAMSON, late sub-station attendant to the Poplar electricity undertaking, has been awarded the Military Medal.

Private T. MACDONALD, of the Cheshire Regiment, killed in action, was at the British Westinghouse Works, Trafford Park.

The Military Cross for gallantry in action has been awarded to Captain H. S. LAVERACK, East Yorkshire Regiment, formerly an engineer at Messrs. Siemens Bros. Dynamo Works at Stafford.

Private E. L. GORDON, Royal Warwickshire Regiment, who has died of wounds received in action, was with Messrs. Bullers, Ltd., of Hanley.

Second-Lieutenant J. E. TOWNSEND, R.F.C., who has been killed whilst flying at Bristol, was at the Rugby works of the British Thomson-Houston Co., Ltd.

Obituary.—MR. F. FARQUHAR.—The death has occurred, at the age of 39 years, of Mr. Francis Farquhar, manager of the electrical department of Messrs. Claud Hamilton, Ltd., Aberdeen.

MR. R. W. MARTIN.—Mr. Richard W. Martin, electrical engineer, of Castle Cary, aged 35 years, was killed whilst motor cycling on January 13th. He collided with the wheel of a trap after turning a corner, and he died the next night after undergoing an operation.

MR. W. TALLETT.—The death has taken place, suddenly, at the age of 50, of Mr. Wm. Tallett, electrician, of Malvern, who was for nearly 30 years engaged in the business of Messrs. Sparkes & Houlton, Ltd., of Malvern.

NEW COMPANIES REGISTERED.

William Taylor (Electric Lamp) Co., Ltd. (145,750).—This company was registered on January 11th, with a capital of £300 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are: W. Taylor, 8, India Street, E.C., electrical engineer; J. Berg, 8, India Street, E.C., insurance broker. Private company. W. Taylor is the first permanent director. Registered office: 8, India Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Woking Electric Supply Co., Ltd.—Issue on various dates from May 24th, 1914, to May 2nd, 1915, of debentures totalling £2,630 (£1,200 being conversions), parts of a series of which particulars have already been filed. (Notice filed January 11th, 1917.)

Electric Construction Co., Ltd.—Satisfaction of debenture stock: The whole of the £50,000 4½ per cent. redeemable second mortgage debenture stock secured by trust deed of February 18th, 1899, was redeemed by purchase in 1909-10, but resolutions were passed by the board to keep the stock alive for purpose of re-issue. By board resolution of January 11th, 1917, the whole of the said stock was cancelled, and the property comprised in the trust deed has been released.

Burnham & District Electric Supply Co., Ltd.—Debentures dated January 2nd, 1917, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Lloyds Bank, Ltd.

Tyne Electric Steel Foundries, Ltd.—Issue on December 18th, 1916, of £5,700 debentures, part of a series of which particulars have already been filed.

Issue of January 12th of £4,500 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

French Electrical Companies.

The accounts of the *Société Gramme* show gross profits amounting to £23,000 for the year 1915-16, as compared with £17,000 in the previous twelve months, and net profits of £10,000 and £4,600 in the two years respectively. It is proposed to pay a dividend of £1 2s. per share, being the same rate as in 1914-15, and to place £2,400 to a war reserve fund.

The Compagnie Parisienne de l'Air Comprimé reports for 1915-16 gross profits of £21,000 from the compressed-air business, and interest of £59,000 from investments, as compared with £23,000 in the case of the former department in 1914-15. The net profits amount to £63,000, as in the previous year, and the dividend is to be at the rate of £1 4s. per share, as in 1914-15.

The accounts of the *Compagnie Générale d'Electricité of Paris* show gross profits of £199,000 for 1915-16, as compared with £163,000 in the previous year. After defraying interest charges on loans, &c., the net profits are stated to have reached £172,000, including the balance forward, as compared with £124,000 in 1914-15. The directors recommend the payment of a dividend of £2 per share, as against £1 in the preceding twelve months.

The Société Industrielle des Téléphones, which owns six manufactories (of which five are situated in the war zone), reports gross profits for 1915-16 amounting to £260,000, as compared with £117,000 in the preceding year. After deducting general expenses and interest on loans, the net profits are returned at £204,000, as against £73,000 in 1914-15. The sum of £60,000 has been set aside for depreciation, as compared with £30,000 in the previous year, and £44,000 has been placed to the contingency fund. The recent meeting sanctioned the payment of a dividend of £1 4s. per share, this comparing with 12s. per share in 1914-15. It was then mentioned that the cable steamer *Francois Arago* had been sold, and the amount of the difference between the book price and that realised from the sale had been devoted to depreciation of the works at Calais.

Austrian Companies.

The Oester. Brown-Boveri Werke, of Vienna, report net profits amounting to £32,000 for the year ended on June 30th, 1916, most of which has been applied to the extinction of the loss incurred in 1914-15. It is stated that in consequence of the larger turnover, and the increased demands made upon the productive capacity, the company intends to erect large works on the outskirts of Vienna. The necessary funds are to be provided by the augmentation of the ordinary share capital from £187,000 to £354,000, which issue is being taken over by the Austrian Daimler Motor Co. At the same time, an agreement of long duration has been concluded between the two companies, the association of the Motor Co. bringing Baron von Skoda within the scope of the electrical industry. The existing capital of the Brown-Boveri Co. is held partly by the United Electricity Co., of Vienna, and partly by a syndicate composed of the Lower Austrian Discount Co., the Pesth Commercial Bank, and the Swiss firm of Brown-Boveri.

The report of the *Ver. Elektrizitats Gesellschaft, of Vienna*, states that the company's works continued to develop in 1915-16. The manufacturing firms associated with the company were fully occupied during the year, and were also now employed to the limit of their capacity. In the case of the electricity supply works, the consumption of energy had increased everywhere, and the traffic on the tramways had also expanded. On the other hand, the prices of raw and other materials had risen beyond every expectation. The United Glow Lamp & Electricity Co., of Ujpest, in which the company was interested, had paid a dividend of 12 per cent. for 1915-16, as compared with 8 per cent. in 1914-15, and the United Electricity & Machinery Works, of Pest, had again been able to distribute 6 per cent. The Austrian Brown-Boveri Co. was exceptionally well provided with orders for the Army authorities and for private customers. The accounts of the Ver. Elek. Ges. indicate net profits of £37,000, as against £44,000 in 1914-15, and the dividend is at the rate of 7 per cent., as compared with 4 per cent. in the previous year.

Aluminium Corporation, Ltd.—The Aluminium Corporation has deposited a Bill for introduction into Parliament next session "to arrange for the extinction of its participating shares." The preamble states that 5,000 of these participating shares were issued at the incorporation of the company in 1900, and are now entitled to a dividend "equal to eight times the dividend of 7 per cent. payable on each £1 of the preference stock, and, on a return of assets, to the sum of £8 in respect of each participating share." The Bill, therefore, proposes to empower the Corporation to increase its capital by the creation of £40,000 preference stock, and to distribute this stock among the holders of the participating shares in the proportion of £8 of the stock for each 1s. share. The new preference stock is to rank equally with the existing preference stock, and is to be entitled to the three years' cumulative dividend of 7 per cent. now in arrear on that stock.—*Times.*

Northampton Electric Light & Power Co., Ltd.—The new issue of shares has been subscribed for in a manner with which the directors are quite satisfied. Applications were sent in for 29,935 shares, and these have all been allotted. The issue was of 50,000 £1 shares at par, and had the prospectus been sent out a few days earlier, and the clash with the War Loan avoided, there is no doubt that it would have been over-subscribed. There will not be the slightest difficulty in obtaining the full £50,000, and the new works are being pushed forward with the fullest possible speed.

The New War Loan.—The General Electric Co., Ltd., have taken up the new war loan to the extent of £200,000, of which £100,000 is new money.

A number of other well-known electrical and engineering concerns appear in the newspaper lists as large subscribers, among them being British Insulated & Helsby Cables, Ltd., Mather & Platt, Ltd., Automatic Telephone Manufacturing Co., Ltd., the Federation of British Industries, &c.

Brazilian Traction, Light & Power Co., Ltd.—Dividend, 1 per cent. on the ordinary capital stock, payable March 1st.

STOCKS AND SHARES.

TUESDAY EVENING.

The question which continues to engage most discussion in the Stock Exchange is whether national interest is served by vicarious selling of securities in order that the money may be put into the War Loan. This applies to all the markets, but particularly those connected with investment stocks and shares.

Talking the matter over with a well-known member of the electric lighting and supply section, he took the view, which is supported by a good many other people in the House, that whereas if a holder of shares sells them in the Stock Exchange the buyer probably utilises money which in any case would not have been put into the War Loan; and accordingly the capital which is furnished by the realisation of the shares is definitely assured of going into the War Loan if the seller has made up his mind to apply it in this way.

The buyer in the Stock Exchange would regard the money which he pays for the shares as being part of his capital, and therefore to be employed in the business. His surplus funds would go into the War Loan, but not his ordinary working capital; and it is the latter which he uses for the purchase of shares from present holders. The chain of the argument has one or two weak links. If this process were carried out all round, the logical consequence would be a severe slump in all other securities, and an indirect damaging of the credit of the War Loan itself by-and-bye. It is further open to the objection that it affords too much opportunity to the ever-present bargain-hunter. But, on the whole, there is a good deal to be said for it; and that proprietors of stocks and shares are acting in the manner indicated is seen from the way in which the course of quotations tends quietly downwards.

This tendency is noticeable amongst the Home Railway debenture and other pre-ordinary stocks. Instead of standing at levels which return 4¾ to 5 per cent. on the money, as the stocks did just lately, prices have come down to levels at which 5¼ or 5½ per cent. is to be derived from the best-class issues in this market. The prior-charge stocks of the Underground Railway companies have not varied much. They had their fall, as a matter of fact, some six weeks ago, and have rested at the lower figures then established.

Business round the House is quiet, as, indeed, is appropriate, considering the War Loan. Naturally, no attempt is being made by the Stock Exchange to advance the claims of other securities to the attention of investors. The way is being left open for the War Loan, and that alone, unanimous effort being directed towards assuring for this the all-round success which it can only hope to achieve by a good deal of work on the part of those intimately concerned, and a certain amount of self-sacrifice on the part of the country generally.

In the circumstances, prices are remarkably firm. The week started in rather an amusing fashion, in consequence of the weather conditions, which brought about failure of the electric current on some of the suburban lines. This furnished glorious excuses for the unpunctual office boy, and disorganised for an hour or two the arrangements of a good many other people. Prices on the whole are steady. There is little business being done in the shares of the Underground Electric Railways; the 6 per cent. income bonds fell ⅛ to 90¼, and the shilling shares are easier at 6s. Metropolitan Surplus Lands dropped to 46, and Central London ordinary shed a point. London Electric debenture is 2 down at 67¼.

Pending the declaration of the February dividends, there is next to nothing in electricity supply shares. The prospects of the success of the "Safety First" campaign do not seem to be particularly bright; and so even this little bull point is becoming dimmed. Therefore the prices of stocks and shares in all the illumination companies are slightly depressed. City Lights and County ordinary are 5s. lower. Of the foreign shares, Madras gave way to 14s.

The same quietude is noticeable in the list of manufacturing shares. General Electric preference fell 5s., and Electric Constructions remain heavy at 20s. A fall of 27s. 6d. in British Aluminium ordinary was brought about by efforts to realise on the part of those who had recently bought the shares lower down, and wanted to take their profits, presumably with the intention of putting the money into the War Loan. A little animation occurred in these; otherwise, the course of the market has been placid almost to stagnant.

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SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price Jan. 28, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	10	6⅝	—	£7 11 0
Charing Cross Ordinary	5	5	3⅝	—	7 8 2
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	6	4	9	—	6 13 4
City of London	9	8	11	— ¼	7 5 5
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10	— ¼	7 0 0
do. 6 per cent. Pref.	6	6	9⅞	—	6 1 6
Kensington Ordinary	9	7	8⅝	—	6 4 5
London Electric	4	3	1⅛	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4⅞	—	6 15 4
Metropolitan	3½	3	2¼	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	2½	—	6 19 0
South Metropolitan Pref.	7	7	1-⅝	—	6 7 3
West'minster Ordinary	9	7	6⅜	—	6 4 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	94	+1	6 7 8
do. Def.	80/-	83/6	22½	— ½	6 14 10
Chile Telephone	8	8	7xd	—	5 14 8
Cuba Sub. Ord.	5	5	3⅝	—	6 8 6
Eastern Extension	7	8	13⅛	—	*5 15 4
Eastern Tel. Ord.	7	8	188	—	*5 16 0
Globe Tel. and T. Ord.	6	7	12½	—	*5 14 8
do. Pref.	6	6	9⅝	—	6 1 6
Great Northern Tel.	22	22	37	—	5 19 0
Indo-European	13	13	49	—	6 12 8
Marconi	10	10	2½	—	8 14 9
New York Tel. 4½	4½	4½	101	—	4 9 0
Oriental Telephone Ord.	10	10	9½	—	4 9 0
United R. Plate Tel.	8	8	6⅜	— ⅛	*8 0 9
West India and Pan.	1	6d.	1	—	2 4 0
Western Telegraph	7	8	13⅝	—	*5 15 4
HOME RAILS.					
Central London, Ord. Assented	4	4	64½	—1	6 5 0
Metropolitan	1½	1	28½	—	4 5 1
do. District	Nil	Nil	16⅝	—	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—6d.	Nil
do. do. Income	6	6	90½	— ½	*6 12 7
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅛	—	6 1
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 4
do. 2nd Pref.	5½	5½	2⅛	—	—
do. 5 Deb.	5	5	64½	—	7 15 0
Brazil Tractions	4	4	49	—	8 3 4
Bombay Electric Pref.	6	6	10½	—	5 17 3
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 1 4
do. do. Preferred	—	Nil	44	—	Nil
do. do. Deferred	—	Nil	38½	—	Nil
do. do. Deb.	4½	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	25	—	Nil
do. 6 per cent. Bonds	—	Nil	22½	—	Nil
Mexican Light Common	Nil	Nil	7⅛	—	Nil
do. Pref.	Nil	Nil	15½	—	Nil
do. 1st Bonds	Nil	Nil	27½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	21½	—	5 6 9
British Aluminium Ord.	5	7	27/6	—1/-	5 16 8
British Insulated Ord.	15	17½	11⅝	—	7 5 10
British Westinghouse Pref.	7½	7½	2-⅝	—	6 11 4
Callenders	15	20	12¾	— ½	7 17 0
do. 5 Pref.	5	5	4	— ½	6 5 0
Castner-Kellner	20	22	5-⅛	—	6 12 7
Edison & Swan, £3 paid	Nil	—	7/8	—	Nil
do. do. fully paid	Nil	—	1⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	61½	—	6 10 1
Electric Construction	6	7½	1-⅝	—	8 0 0
Gen. Elec. Pref.	6	6	9½	— ½	6 6 4
do. Ord.	10	10	15⅝	—	7 5 6
Henley	20	25	16	—	7 13 10
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12½	—	*8 0 0
Telegraph Con.	20	20	38	—	*5 5 0

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1916.

THE official returns of electrical export and import business for the last month of the year just ended show a further falling off in value of the exports—the decline having set in in October—and a considerable appreciation in import values.

The total value of the December exports was £405,921, as compared with £438,830 in the preceding month; the only branches of business attaining a higher level than in November were machinery, battery, and telegraphic exports, while considerably reduced values were recorded in telephonic, cable, and lamp exports particularly.

The imports total for the month of £246,252 was much in excess of the November figure of £198,492, increased values of cable, lamps, battery, and telegraphic and telephonic material having entered this country, in comparison with November. Electrical machinery imports were only a trifle in excess of those of the previous month.

The re-exports at £13,104 show a reduction of some £5,000 on the November figures.

Export business with India showed some improvement, and French purchases, though less than in November, were little less valuable than India's.

Practically all the importers into this country increased their business during the month, the U.S. more particularly so.

Dutch imports reached nearly £28,000 in value, and Japan—the newcomer—shows a total of £17,700.

It will be noted that nearly £62,000 worth of lamps and parts entered this country during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,229	4,890	580	38	607	1,826	36,946	1,799	118	521	848	3,047	53,449
Netherlands, Java and Dutch Indies ...	512	10,466	826	22	61	140	1,096	445	190	324	2,625	247	16,954
Belgian Congo...	36	4	8	23	5	13	...	...	6	...	145	20	260
France	2,665	721	1,332	236	12	184	21,308	6,230	467	43	2,195	11,360	46,753
Portugal	5	2,651	41	227	5	44	514	...	386	...	112	3,242	7,227
Spain, Canary Isles and Spanish N. Africa...	202	210	512	19	...	1,266	5,296	23	151	...	...	792	8,471
Switzerland, Italy and Austria-Hungary ...	791	14	...	...	...	37	17,446	56	321	...	306	4,127	23,098
Greece, Roumania, Turkey and Bulgaria ...	516	...	10	23	...	7	3,500	...	23	...	...	...	4,079
Channel Isles, Gibraltar, Malta and Cyprus...	91	426	4	17	...	66	17	...	17	...	18	400	1,056
U.S.A., Philippines and Cuba	851	...	489	2	14	...	5,080	...	...	5	247	6,237	12,925
Canada and Newfoundland	133	31	672	166	7	535	1,789	...	328	39	...	20,266	23,966
British West Indies and British Guiana ...	109	56	...	6	10	...	...	...	20	21	5	299	526
Mexico and Central America	22	252	116	3	...	9	36	...	...	...	400	...	838
Peru and Uruguay	9	9	183	9	...	...	215	...	6	14	...	4	449
Chile	527	690	6	184	2	79	899	...	88	13	1,180	73	3,741
Brazil	84	363	459	253	7	535	763	378	56	26	7	1,486	4,417
Argentina	704	4,343	704	934	...	448	2,203	235	703	104	296	6	10,680
Colombia, Venezuela, Ecuador and Bolivia...	7	109	2	81	...	...	1,431	...	...	1	...	6	1,637
Egypt, Tunis and Morocco	192	737	157	472	9	...	2,640	...	367	47	42	407	5,070
British West Africa	233	96	7	62	32	...	567	...	628	7	360	556	2,548
Rhodesia, O.R.C. and Transvaal	878	1,714	611	412	...	100	3,088	95	110	19	206	6	7,239
Cape of Good Hope	122	886	406	199	14	305	1,665	179	232	24	...	1,427	5,459
Natal	1,142	2,268	428	16	11	333	892	...	2,236	9	291	8	7,364
Zanzibar, Brit. E. Africa, Mauritius & Aden	75	30	246	55	...	89	476	1,262	10	5	519	113	2,880
Azores, Madeira and Portuguese Africa ...	22	42	21	93	...	416	183	...	4	1	19	302	1,103
French African Colonies and Madagascar...	8	52	...	25	...	...	26	...	...	...	...	...	111
Persia	...	...	...	8	...	...	7	...	...	21	7	...	43
China and Siam	615	3,334	583	731	...	1,368	4,064	235	345	10	27	41	11,353
Japan and Korea	1	10	9	9	20	246	2,360	500	340	...	16	663	4,174
India	1,774	13,681	4,827	2,487	55	2,574	12,184	3,554	7,335	522	228	710	49,931
Ceylon	257	897	127	78	73	18	6	112	103	...	...	37	1,708
Straits Settlements, Fed. Malay States and Sarawak	612	761	719	374	13	317	778	6	146	...	97	523	4,346
Hong Kong	...	279	541	87	...	375	577	450	145	30	14	58	2,556
West Australia	162	330	182	332	6	48	204	...	16	5	...	6	1,291
South Australia	37	393	279	393	...	524	591	...	326	4	2,100	167	4,814
New South Wales	1,139	5,454	1,112	1,090	10	1,180	8,534	2,080	918	49	520	7	22,093
Victoria	4,001	7,162	2,325	859	...	626	8,273	1,230	260	...	2,031	29	26,796
Queensland	127	576	167	160	...	179	359	...	329	27	482	444	2,850
Tasmania	...	...	196	113	9	...	1,765	...	...	...	...	...	2,083
New Zealand and Fiji Islands	1,009	5,967	1,417	1,186	8	293	1,815	2,198	760	22	4,238	400	19,313
Total, £	21,899	69,904	20,304	11,484	990	14,180	149,953	21,067	17,490	1,913	19,581	57,516	405,921

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	244	6,844	...	2,977	885	2,302	994	838	15,084
Netherlands	30	...	...	16,473	9,677	...	90	...	1,654	...	...	27,924
France	162	4,787	156	...	389	796	2	...	8,508	2,225	411	17,436
Switzerland	1,050	...	113	163	...	1,708	5,935	...	2,728	547	...	12,244
Italy	...	2,873	...	...	...	...	...	...	...	...	200	3,073
Japan	632	...	215	7,767	8,027	...	...	...	1,070	...	...	17,711
United States	7,838	7,930	1,203	6,147	5,804	1,356	9,675	34,088	15,208	6,081	55,688	151,018
Total, £	9,712	15,590	1,687	30,794	30,741	3,860	18,679	34,973	31,470	9,847	56,137	244,490

Additional imports.—Spain, carbons, £700. Canada, glow lamps, £288; arc lamp parts, £25; batteries and accumulators, £639; electrical goods, £110.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	1,604	696	...	4,622	765	1,017	2,443	...	334	105	1,518	13,104

TOTAL EXPORTS: £405,921 TOTAL RE-EXPORTS: £13,104 TOTAL IMPORTS: £246,252

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin

The New War Loan.—The General Electric Co., Ltd., have taken up the new war loan to the extent of £200,000, of which £100,000 is new money.

A number of other well-known electrical and engineering concerns appear in the newspaper lists as large subscribers, among them being British Insulated & Helsby Cables, Ltd., Mather & Platt, Ltd., Automatic Telephone Manufacturing Co., Ltd., the Federation of British Industries, &c.

Brazilian Traction, Light & Power Co., Ltd.—Dividend, 1 per cent. on the ordinary capital stock, payable March 1st.

STOCKS AND SHARES.

TUESDAY EVENING.

The question which continues to engage most discussion in the Stock Exchange is whether national interest is served by vicarious selling of securities in order that the money may be put into the War Loan. This applies to all the markets, but particularly those connected with investment stocks and shares.

Talking the matter over with a well-known member of the electric lighting and supply section, he took the view, which is supported by a good many other people in the House, that whereas if a holder of shares sells them in the Stock Exchange the buyer probably utilises money which in any case would not have been put into the War Loan; and accordingly the capital which is furnished by the realisation of the shares is definitely assured of going into the War Loan if the seller has made up his mind to apply it in this way.

The buyer in the Stock Exchange would regard the money which he pays for the shares as being part of his capital, and therefore to be employed in the business. His surplus funds would go into the War Loan, but not his ordinary working capital; and it is the latter which he uses for the purchase of shares from present holders. The chain of the argument has one or two weak links. If this process were carried out all round, the logical consequence would be a severe slump in all other securities, and an indirect damaging of the credit of the War Loan itself by-and-bye. It is further open to the objection that it affords too much opportunity to the ever-present bargain-hunter. But, on the whole, there is a good deal to be said for it; and that proprietors of stocks and shares are acting in the manner indicated is seen from the way in which the course of quotations tends quietly downwards.

This tendency is noticeable amongst the Home Railway debenture and other pre-ordinary stocks. Instead of standing at levels which return 4¾ to 5 per cent. on the money, as the stocks did just lately, prices have come down to levels at which 5¼ or 5½ per cent. is to be derived from the best-class issues in this market. The prior-charge stocks of the Underground Railway companies have not varied much. They had their fall, as a matter of fact, some six weeks ago, and have rested at the lower figures then established.

Business round the House is quiet, as, indeed, is appropriate, considering the War Loan. Naturally, no attempt is being made by the Stock Exchange to advance the claims of other securities to the attention of investors. The way is being left open for the War Loan, and that alone, unanimous effort being directed towards assuring for this the all-round success which it can only hope to achieve by a good deal of work on the part of those intimately concerned, and a certain amount of self-sacrifice on the part of the country generally.

In the circumstances, prices are remarkably firm. The week started in rather an amusing fashion, in consequence of the weather conditions, which brought about failure of the electric current on some of the suburban lines. This furnished glorious excuses for the unpunctual office boy, and disorganised for an hour or two the arrangements of a good many other people. Prices on the whole are steady. There is little business being done in the shares of the Underground Electric Railways; the 6 per cent. income bonds fell ¼ to 90¼, and the shilling shares are easier at 6s. Metropolitan Surplus Lands dropped to 46, and Central London ordinary shed a point. London Electric debenture is 2 down at 67¼.

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Charing Cross Ordinary	5	5	8½	—	7 8 2
do. do. do. 4½ Pref.	4½	4½	8½	—	6 18 6
Chelsea	5	4	8	—	6 18 4
City of London	9	8	11	— ¼	7 5 5
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10	— ½	7 0 0
do. 6 per cent. Pref.	6	6	9⅜	—	6 1 6
Kensington Ordinary	9	7	6⅝	—	6 4 5
London Electric	4	3	1⅛	—	6 10 5
do. do. 6 per cent. Pref.	6	6	4 7/8	—	6 15 4
Metropolitan	3½	3	2⅛	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	9⅜	—	6 19 0
South Metropolitan Pref.	7	7	1-⅞	—	6 7 3
Westminster Ordinary	9	7	5⅜	—	6 4 5
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	94	+1	6 7 3
do. Def.	80/-	83/6	22½	— ½	6 14 10
Chile Telephone	8	8	7xd	—	5 14 3
Cuba Sub. Ord.	5	5	8½	—	6 5 6
Eastern Extension	7	8	15⅝	—	*5 15 4
Eastern Tel. Ord.	7	8	188	—	*5 16 0
Globe Tel. and T. Ord.	6	7	13¼	—	*5 14 3
do. Pref.	6	6	97⅛	—	6 1 6
Great Northern Tel.	22	22	87	—	5 19 0
Indo-European	13	13	49	—	6 13 8
Marconi	10	10	21⅛	—	8 14 9
New York Tel. 4½	4½	4½	101	—	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 9 0
United R. Plate Tel.	8	8	6⅝	— 1/32	*6 0 9
West India and Pan.	1	6d.	1	—	2 4 0
Western Telegraph	7	8	13⅛	—	*5 15 4
HOME RAILS.					
Central London, Ord. Assented	4	4	64½	—1	6 5 0
Metropolitan	1½	1	28½	—	4 5 1
do. District	Nil	Nil	16½	—	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—6d.	Nil
do. do. Income	6	6	90½	— ¼	*6 13 7
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4 13/16	—	6 1
Anglo-Arg. Trams, First Pref.	5½	5½	8	—	9 4
do. 2nd Pref.	5½	5½	22	—	—
do. 5 Deb.	5	5	64½	—	7 15 0
Brazil Tractions	4	4	49	—	8 3 4
Bombay Electric Pref.	6	6	10½	—	5 17 3
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 1 4
do. do. Preferred	—	Nil	44	—	Nil
do. do. Deferred	—	Nil	38½	—	Nil
do. do. Deb.	4½	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	25	—	Nil
do. 6 per cent. Bonds	—	Nil	22½	—	Nil
Mexican Light Common	Nil	Nil	7½	—	Nil
do. Pref.	Nil	Nil	15½	—	Nil
do. 1st Bonds	Nil	Nil	27½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	21½	—	5 6 9
British Aluminium Ord.	5	7	27/6	—1/-	5 16 3
British Insulated Ord.	15	17½	113	—	7 5 10
British Westinghouse Pref.	7½	7½	2⅝	—	6 11 4
Callenders	15	20	12⅜	— ½	7 17 0
do. 5 Pref.	5	5	4	— ½	6 5 0
Castner-Kellner	20	22	8 5/8	—	6 12 7
Edison & Swan, £8 paid	Nil	—	7/16	—	Nil
do. do. fully paid	Nil	—	1⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	61½	—	6 10 1
Electric Construction	6	7½	1 3/8	—	8 0 0
Gen. Elec. Pref.	6	6	9½	— ½	6 6 4
do. Ord.	10	10	13½	—	7 5 6
Henley	20	25	16	—	7 13 10
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	19½	—	*8 0 0
Telegraph Con.	20	20	38	—	*6 6 0

* Dividends paid free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1916.

THE official returns of electrical export and import business for the last month of the year just ended show a further falling off in value of the exports—the decline having set in in October—and a considerable appreciation in import values.

The total value of the December exports was £405,921, as compared with £438,830 in the preceding month; the only branches of business attaining a higher level than in November were machinery, battery, and telegraphic exports, while considerably reduced values were recorded in telephonic, cable, and lamp exports particularly.

The imports total for the month of £246,252 was much in excess of the November figure of £198,492, increased values of cable, lamps, battery, and telegraphic and telephonic material having entered this country, in comparison with November. Electrical machinery imports were only a trifle in excess of those of the previous month.

The re-exports at £13,104 show a reduction of some £5,000 on the November figures.

Export business with India showed some improvement, and French purchases, though less than in November, were little less valuable than India's.

Practically all the importers into this country increased their business during the month, the U.S. more particularly so.

Dutch imports reached nearly £28,000 in value, and Japan—the newcomer—shows a total of £17,700.

It will be noted that nearly £62,000 worth of lamps and parts entered this country during the month.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,229	4,890	580	38	607	1,826	36,946	1,799	118	521	848	3,047	53,449
Netherlands, Java and Dutch Indies ...	512	10,466	826	22	61	140	1,096	445	190	324	2,625	247	16,954
Belgian Congo...	36	4	8	23	5	13	...	...	6	...	145	20	260
France	2,665	721	1,332	236	12	184	21,308	6,230	467	43	2,195	11,360	46,753
Portugal	5	2,651	41	227	5	44	514	...	386	...	112	3,242	7,227
Spain, Canary Isles and Spanish N. Africa...	202	210	512	19	...	1,266	5,296	23	151	...	...	792	8,471
Switzerland, Italy and Austria-Hungary ...	791	14	...	...	...	37	17,446	56	321	...	306	4,127	23,098
Greece, Roumania, Turkey and Bulgaria ...	516	...	10	23	...	7	3,500	...	23	...	...	...	4,079
Channel Isles, Gibraltar, Malta and Cyprus...	91	426	4	17	...	66	17	...	17	...	18	400	1,056
U.S.A., Philippines and Cuba	851	...	489	2	14	...	5,080	...	...	5	247	6,237	12,925
Canada and Newfoundland	133	31	672	166	7	535	1,789	...	328	39	...	20,266	23,966
British West Indies and British Guiana ...	109	56	...	6	10	...	...	...	20	21	5	299	526
Mexico and Central America	22	252	116	3	...	9	36	...	...	...	400	...	838
Peru and Uruguay	9	9	183	9	...	...	215	...	6	14	...	4	449
Chile	527	690	6	184	2	79	899	...	88	13	1,180	73	3,741
Brazil	84	363	459	253	7	535	763	378	56	26	7	1,486	4,417
Argentina	704	4,343	704	934	...	448	2,203	235	703	104	296	6	10,680
Colombia, Venezuela, Ecuador and Bolivia...	7	109	2	81	...	...	1,431	...	...	1	...	6	1,637
Egypt, Tunis and Morocco	192	737	157	472	9	...	2,640	...	367	47	42	407	5,070
British West Africa	233	96	7	62	32	...	567	...	628	7	360	556	2,548
Rhodesia, O.R.C. and Transvaal	878	1,714	611	412	...	100	3,088	95	110	19	206	6	7,239
Cape of Good Hope	122	886	406	199	14	305	1,665	179	232	24	...	1,427	5,459
Natal	1,142	2,268	428	16	11	333	892	...	2,236	9	291	8	7,364
Zanzibar, Brit. E. Africa, Mauritius & Aden	75	30	246	55	...	89	476	1,262	10	5	519	113	2,880
Azores, Madeira and Portuguese Africa ...	22	42	21	93	...	416	183	...	4	1	19	302	1,103
French African Colonies and Madagascar...	8	52	...	25	...	...	26	...	...	...	...	...	111
Persia	...	...	...	8	...	...	7	...	...	21	7	...	43
China and Siam	615	3,334	583	731	...	1,368	4,064	235	345	10	27	41	11,353
Japan and Korea	1	10	9	9	20	246	2,360	500	340	...	16	663	4,174
India	1,774	13,681	4,827	2,487	55	2,574	12,184	3,554	7,335	522	228	710	49,931
Ceylon	257	897	127	78	73	18	6	112	103	...	...	37	1,708
Straits Settlements, Fed. Malay States and Sarawak	612	761	719	374	13	317	778	6	146	...	97	523	4,346
Hong Kong	...	279	541	87	...	375	577	450	145	30	14	58	2,556
West Australia	162	330	182	332	6	48	204	...	16	5	...	6	1,291
South Australia	37	393	279	393	...	524	591	...	326	4	2,100	167	4,814
New South Wales	1,139	5,454	1,112	1,090	10	1,180	8,534	2,080	918	49	520	7	22,093
Victoria	4,001	7,162	2,325	859	...	626	8,273	1,230	260	...	2,031	29	26,796
Queensland	127	576	167	160	...	179	359	...	329	27	482	444	2,850
Tasmania	...	...	196	113	9	...	1,765	...	...	...	...	...	2,083
New Zealand and Fiji Islands	1,009	5,967	1,417	1,186	8	293	1,815	2,198	760	22	4,238	400	19,313
Total, £	21,899	69,904	20,304	11,484	990	14,180	149,953	21,067	17,490	1,913	19,581	57,516	405,921

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	...	...	244	6,844	...	2,977	885	2,302	994	838	15,084
Netherlands	30	...	...	16,473	9,677	...	90	...	1,654	...	...	27,924
France	162	4,787	156	...	389	796	2	...	8,508	2,225	411	17,436
Switzerland	1,050	...	113	163	...	1,708	5,935	...	2,728	547	...	12,244
Italy	...	2,873	...	...	...	...	...	...	...	...	200	3,073
Japan	632	...	215	7,767	8,027	...	...	...	1,070	...	...	17,711
United States	7,838	7,930	1,203	6,147	5,804	1,356	9,675	34,088	15,208	6,081	55,688	151,018
Total, £	9,712	15,590	1,687	30,794	30,741	3,860	18,679	34,973	31,470	9,847	56,137	244,490

Additional imports.—Spain, carbons, £700. Canada, glow lamps, £288; arc lamp parts, £25; batteries and accumulators, £639; electrical goods, £110.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	1,604	696	...	4,622	765	1,017	2,443	...	334	105	1,518	13,104

TOTAL EXPORTS: £405,921 TOTAL RE-EXPORTS: £13,104 TOTAL IMPORTS: £246,252

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned which is not necessarily the country of origin

ELECTRICAL EXPORTS AND IMPORTS DURING 1916 AND PREVIOUS YEARS.

In accordance with our usual custom, we publish in this issue a graphic summary showing the trend of British electrical export and import business during 1916 and previous years, the curves being based on the monthly statistics supplied to this journal by the Customs authorities.

It is, perhaps, superfluous to write at any length on the factors influencing external electrical business during the year—the war exercises a tighter grip on our industry than it did a year ago, and the difficulties connected with labour, finance, shipping, &c., referred to in our remarks in January last year, have been considerably accentuated, and, indeed, further handicaps in the shape of business restrictions have been added.

Under the circumstances, there would be every excuse for a dwindling export business in electrical goods, but such has not been the case, our overseas electrical business having shown a marked improvement in values over that of the previous year, as will be gathered from the two upper curves of fig. 1.

It will be noted that the extreme fluctuations of value due to telegraphic export business have been absent since the war started, and that the second (dot-and-dash) curve indicating the more steady general business (exclusive of telegraphic material) compares very well with 1912 in value.

The imports curve, on the other hand, does not, on the whole, show any particular appreciation in value during 1916, as compared with the previous year, such as one might expect, although during May and June record values of electrical material entered this country from abroad, and mainly from America.

Although there has been a marked tendency towards the restriction of importation of certain classes of goods into this country, this probably did not affect electrical imports to any extent during the past year; and, indeed, it does not appear probable that any diminution of such business will occur while the war lasts, whatever may be the case afterwards.

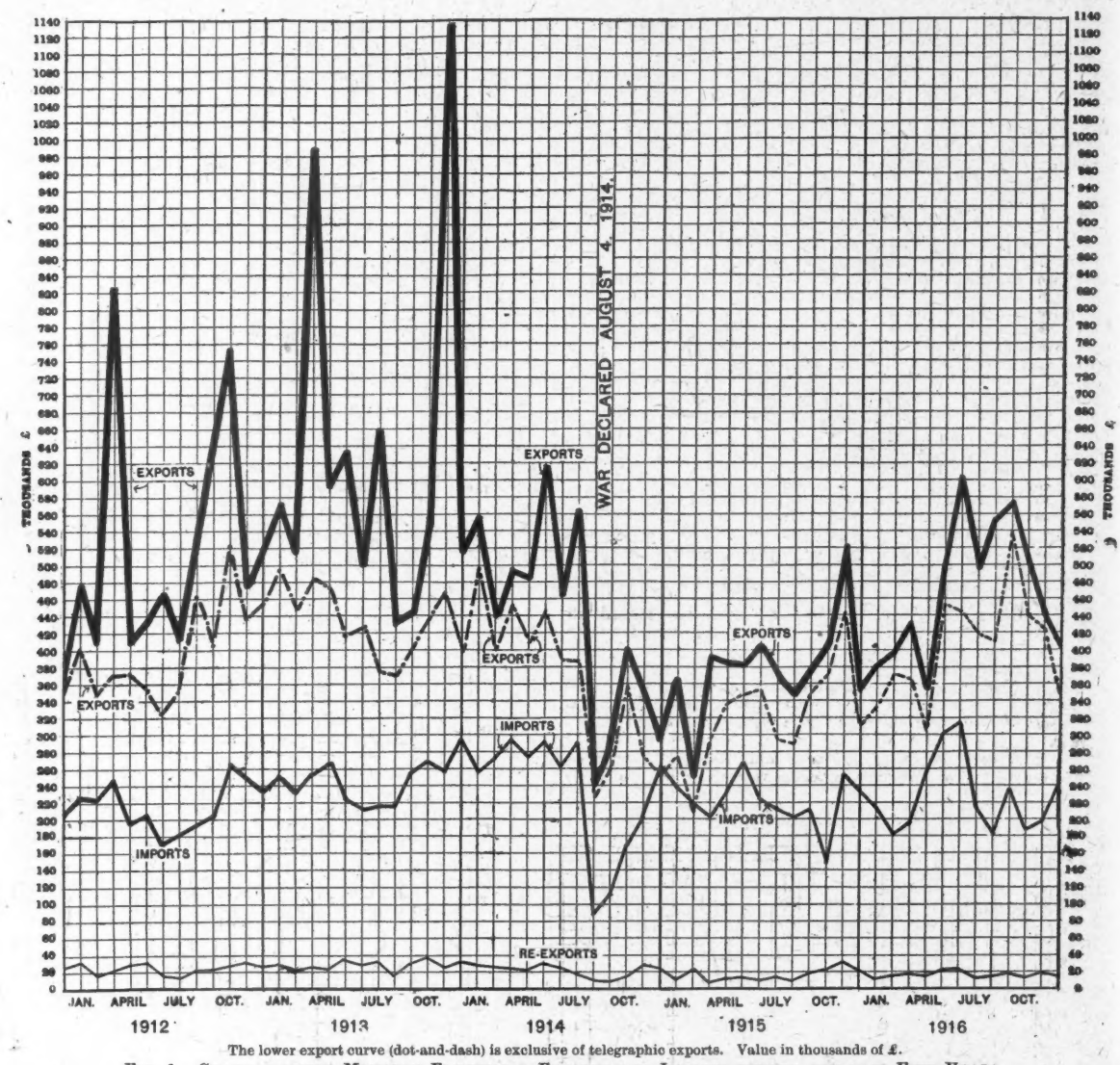
The re-export business was much the same as in the previous year, remaining at a reduced level in comparison with pre-war days.

The gross values of our electrical exports and of the telegraphic materials included therein for the five years covered by the curves in fig. 1 were as follows:—

1912	...	Gross £6,300,000	Telegraphic	£1,500,000
1913	...	„ 7,568,000	„	2,388,000
1914	...	„ 5,189,000	„	835,800
1915	...	„ 4,564,000	„	690,300
1916	...	„ 5,628,000	„	776,300

The respective monthly averages of general business (exclusive of telegraphic exports) were: 1912, £400,000; 1913, £432,000; 1914, £362,000; 1915, £323.000; and 1916, £404,300.

The value of electrical material imported into this country during 1916, according to our monthly statistics, was £2,736,000, representing a monthly average of £228,000. These figures compare with a total of £2,646,000 and monthly average of £220,500 in the previous year, and show a comparatively small appreciation in value



The lower export curve (dot-and-dash) is exclusive of telegraphic exports. Value in thousands of £.

FIG. 1.—CHART SHOWING MONTHLY ELECTRICAL EXPORTS AND IMPORTS DURING THE PAST FIVE YEARS.

under the circumstances, the totals being less than those of 1914 and 1913.

The re-exports showed comparatively little fluctuation from month to month, and only reached a total value of nearly £193,000, thus being even smaller in extent than in 1915, when the total was £198,000. The monthly averages for the two years were £16,000 and £16,500 respectively.

Turning to fig. 2, the curves on which deal with the most prosperous sections of our electrical export business—viz., machinery and cables—it will be seen that these branches have no reason to complain as regards the progress made, the amount of business in both cases showing a marked increase on the previous year.

The electrical machinery export values will not, of course, bear comparison with the palmy pre-war times, but electrical cable exports established a record both for the year's business and for an individual monthly total. For the whole year electrical machinery exports were valued at £1,719,000, as compared with £1,482,000 in 1915; the cable exports reached a total value of £1,342,000, which was much in excess of the previous year's total of £916,000;

further, the value of cable exported in September reached a total of nearly £169,000, being the highest value so far recorded by us. It should be noted that the above cable export figures are exclusive of the values of telegraph and telephone cables, which appear in their own sections.

tinued until last May, when an abnormal total—some £75,000—was reached, the values subsequently dropping away to normal at the end of the year.

Throughout the greater part of the year the importation of electric lamps and parts reached abnormal values, which show little signs

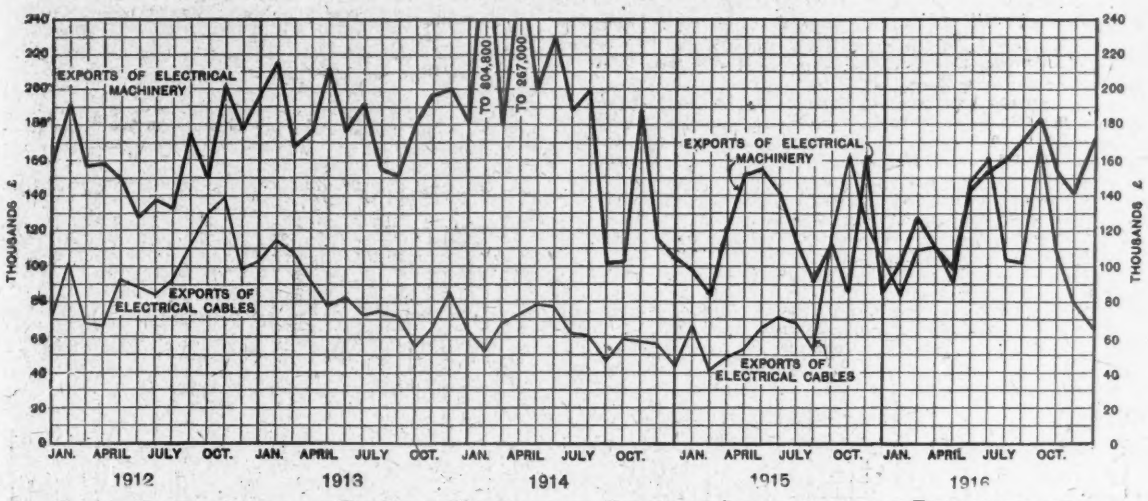


FIG. 2.—MONTHLY EXPORTS OF ELECTRICAL MACHINERY AND ELECTRICAL CABLE—OTHER THAN TELEGRAPHIC AND TELEPHONIC CABLE—DURING THE PAST FIVE YEARS.

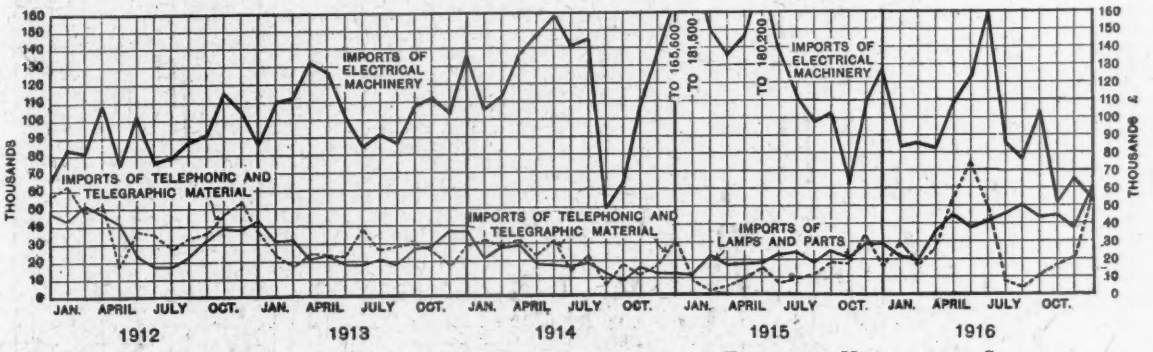
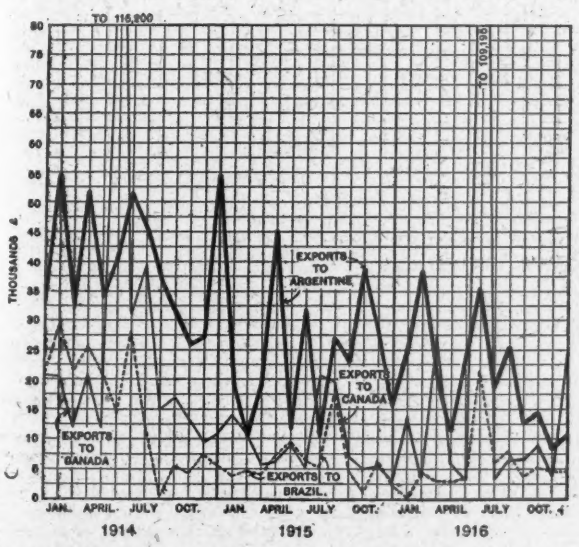


FIG. 3.—MONTHLY IMPORTS OF ELECTRICAL MACHINERY, TELEGRAPHIC AND TELEPHONIC MATERIAL AND CABLE, AND ELECTRIC LAMPS AND PARTS DURING THE PAST FIVE YEARS.

Fig. 3, containing representative curves of value for machinery, telegraph and telephone, and lamp imports, shows, as regards the first-named, a decided falling off in comparison with the previous year.

The values of telegraphic and telephonic material imported into this country showed an upward tendency during 1915, which con-



Upper curve includes New Zealand, Australian States and Tasmania; lower curve includes Cape, Natal, Transvaal and Orange River Provinces, and Rhodesia.

FIG. 4.—ELECTRICAL EXPORTS TO CANADA, ARGENTINA AND BRAZIL, 1914-16.

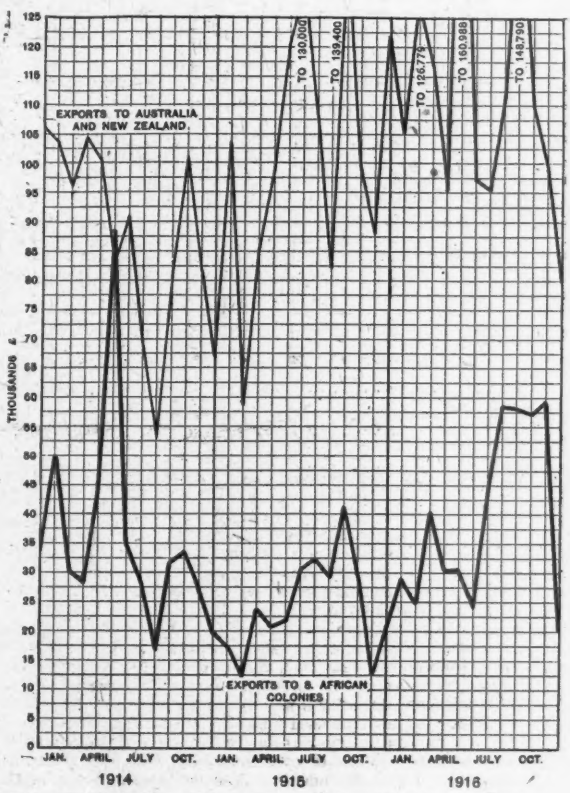


FIG. 5.—ELECTRICAL EXPORTS TO AUSTRALASIA AND SOUTH AFRICA, 1914-16.

of falling off. The following total figures for the last two years are of interest :—

Imports.	*1915.*	*1916.*
Machinery...	£1,543,000	£1,080,000
Telegraph and telephone material...	154,600	368,000
Lamps and parts	256,600	483,000

Purchasing Countries and Importers into the United Kingdom.

Figs. 4 to 9 deal with another phase of our electrical business, which is of considerable interest in view of the widespread effect of the war on international trade. In this connection, figs. 4, 5, and 6 indicate the course of business in what are normally progressive markets for British goods, and it will be noticed that while Argentinean business continued to fall off during 1916, and electrical exports to Brazil and Canada remained in a depressed state, yet trade with India, China, and our Australasian and South African Colonies has shown a gratifying revival, the upward tendency being strongly marked in some cases.

Our export business to Japan, with the exception of one month in which some £100,000 worth of telegraphic material was included, on the whole remained lifeless, although reaching a greater total due to the above cause than in 1915.

The position is not an unexpected one, as the Japanese electrical manufacturing business has undoubtedly made great strides during the last few years ; so much so, indeed, that her name now figures

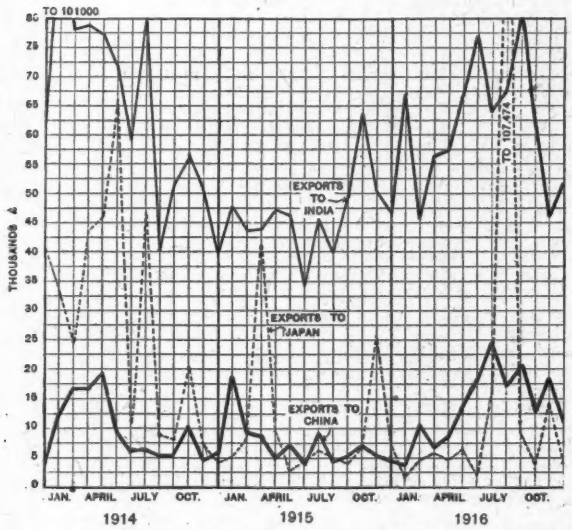


FIG. 6.—ELECTRICAL EXPORTS TO JAPAN, INDIA AND CHINA, 1914-16.

as an importer of electrical material into this country to quite a considerable amount. Undoubtedly the most satisfactory branch of our electrical export business is that with Australia and New Zealand (see fig. 5), which has shown a continuous improvement on pre-war times despite difficulties in communication. The improvement in South African business may, perhaps, be traced to the withdrawal of German competition, and no doubt progress in China—the country of great expectations—is due to a similar cause. It should be noted, however, that Japan in some branches of electrical business is beginning to compete in India, China, and South Africa, and no doubt the effect will be felt in the next year or two.

The gross value of our electrical exports to the above-mentioned countries for the years 1914, 1915, and 1916 were as follows :—

	1914.	*1915.*	*1916.*
India	£784,000	£557,000	£743,000
Australia and New Zealand...	1,032,000	1,234,000	1,345,000
Argentina	448,000	279,000	244,000
South Africa	434,000	293,000	476,000
Canada	318,000	112,000	217,000
Japan...	320,000	128,000	179,000
Brazil...	176,000	73,000	68,000
China...	117,000	88,000	166,000

As pointed out in our remarks a year ago, the war has caused a partial redistribution of our electrical export business, and allied and neutral European nations account for a much larger proportion of value than in pre-war days. The figures for French purchases from us, for instance, show continuous expansion for the last three years, viz., 1914, £150,000 ; 1915, £321,000 ; and 1916, £601,559 ; it will be noted that, with the latter total, France has become one of our very best customers for electrical goods, and it is to be hoped that means will be found to permanently secure the goodwill of our near neighbours in this branch of trade.

The Scandinavian group of countries, together with Russia, purchased £474,000 worth of electrical material from us during 1916, as compared with £465,000 worth in 1915, and £253,000 worth in 1914, showing that this branch of business has improved, though not to the extent of the previous year.

The last set of curves, in fig. 7, deals with the principal countries importing into Britain, amongst which the United States has occupied the premier position since German overseas business was abruptly suspended in August, 1914.

Although our American cousins sold to us, roughly, 63 per cent. of our total purchases of electrical material, recent months have shown a falling off in values, and, on the whole year, the total of £1,700,000 was less than for 1915 (£1,855,000), though still in excess of the best effort of Germany in pre-war days, viz., £1,632,000 in 1913.

From France we received a smaller value of electrical material, viz., £151,000 worth, as compared with £167,000 worth in 1914.

Belgian business disappeared early in 1915, but Dutch imports—mainly in the form of lamps—attained such solid proportions during the year, that we have given her a place on the chart, as also Japan, for reasons which will be apparent from preceding remarks.

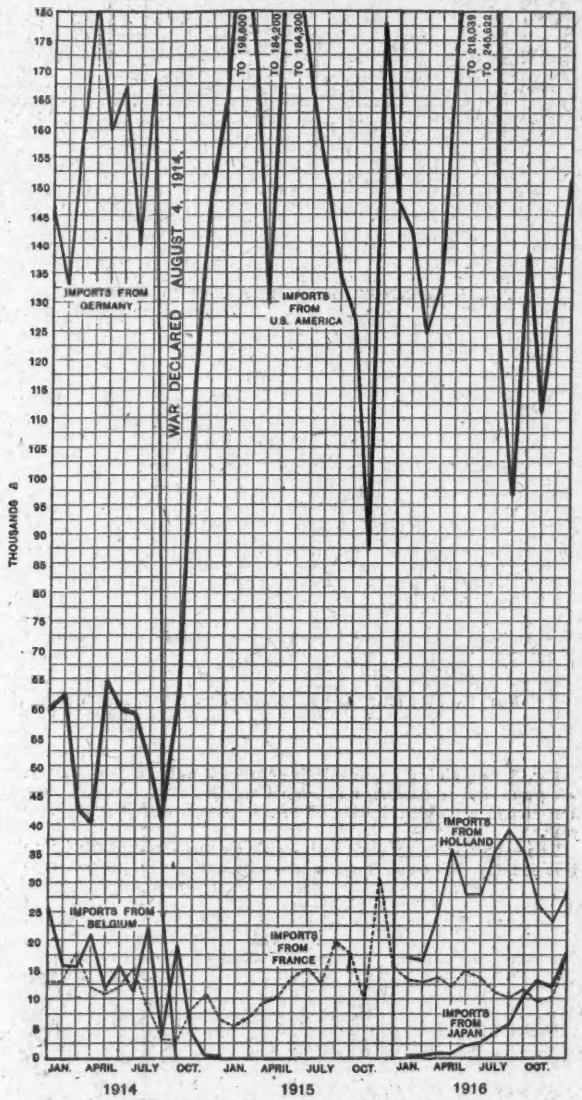


FIG. 7.—ELECTRICAL IMPORTS FROM THE UNITED STATES AND FRANCE DURING 1914-16 ; FROM HOLLAND AND JAPAN IN 1916 ; AND FROM GERMANY AND BELGIUM IN 1914.

Dutch electrical imports into this country ranked next to those of the United States in value, amounting to £337,000 in 1916, as compared with £153,000 in the previous year, and only £60,000 in 1914.

Of the Dutch total, lamps and parts account for some £311,000 in value, or nearly £26,000 a month, as against £10,000 a month in 1915, and only £1,400 a month before the war. No doubt we are engrossed in more vital occupations than lamp making, otherwise the situation would be extremely disappointing.

General.—In concluding our remarks, we can only point out that, with the duration of the war still uncertain, and so many adverse factors present, the prospects of the electrical industry are naturally overcast at the moment.

One may well ask, however, whether in the event of a sudden cessation of hostilities, there is any prospect of our electrical industry being prepared for the task which may confront it in the event of a regrouping of international trade relationships taking place. It cannot be denied that an industry which in normal times exported material worth six or seven millions sterling annually, while at the same time competing material from abroad valued at some 2½ millions a year was sold almost on its doorsteps, has considerable need to set its house in order.

TRADE AFTER THE WAR.

THE third report of the Special Committee on Trade during and after the war, to the Council of the London Chamber of Commerce, is divided into four sections. No. 1 deals with Commercial and Industrial Organisation generally. Herein it is stated that the question of improved methods of business after the war naturally involves some possible difference of opinion according to the requirements of particular trades, industries, or markets, and that so-called "improvements" are of value only to the extent to which they are practicable, and can be best appreciated when existing methods are understood and explained. There is also a wide distinction between the methods employed in the home and overseas markets respectively. The Committee affirm their conviction that the practical application of measures for the extension of trade and industry after the war will be mainly a matter for private enterprise. Merchants and manufacturers alike are alive to the need for preparation on business lines, but there are certain measures which can only be effective with the discriminating support of the Government, whose aid, as in the past, should, broadly speaking, only be given with regard to action which the individual himself is unable to take. Apart from the question of discriminating tariffs, Government intervention is only considered desirable within certain defined limits. A closer connection between the business community through their appointed representatives and the various Government Departments—co-ordinated as far as possible through a Ministry of Commerce—is held to afford the most likely prospect that co-operation between trade interests and the Government will be really effective. There is found to be a growing tendency to organise collective representation of manufacturers or merchants on a co-operative basis through the agency of persons, firms, companies, or associations for both the overseas and home trade. This plan, which has been applied successfully by engineering and other firms, affords a means of reducing the expenses of individual action and ensuring capable representation, more especially in foreign countries. The Committee holds, however, that export merchants representing a number of manufacturers in similar lines will probably continue, in view of their foreign connections and financial standing, to be valuable auxiliaries in the promotion of British trade. There is a necessity in many trades for the larger employment of competent commercial representatives to bring goods directly under the notice of the retailer or consumer; also the appointment of travelling representatives to visit agents where principals themselves are not available. The need for a combination of linguistic ability with technical knowledge emphasises the need for the study of foreign languages at an early age or concurrently with the acquisition of technical knowledge. The requirements of common interest to all traders in which State aid is desirable relate to:—A tentative tariff; a Ministry of Commerce and Industry; the improvement of the commercial side of the Consular service; the restriction of the operations of enemy traders within the Empire after the war, perhaps by continuing in force many of the provisions of the Trading with the Enemy and other emergency Acts; the improvement of means of transport on land and water, and penalising enemy shipping as recognised in the Paris Economic Conference recommendations; and the co-operation of the State in the promotion of a Trade Bank or Banks, to furnish financial accommodation of a special kind to traders doing business abroad, not otherwise provided for under the existing system.

If the foregoing requirements are satisfied, little assistance will be required enabling the adoption of more effective voluntary action in regard to:—The printing of trade catalogues in various foreign languages; the greater use of the metric system of weights, measures, and currency; the establishment of improved British organisations for obtaining information as to the status of foreign clients; and the holding of trade exhibitions at home, abroad, and in the Dominions.

In regard to industrial organisation, the Committee says that the vital interests of the manufacturer in the whole scheme of economic progress of the country must be recognised, whether in relation to the home or the export trade, and his claim to special recognition in the matter of tariffs and well-directed State aid is indisputable. "The State must clearly play a more active, and even sympathetic, part in these problems, without undue interference with the development of private enterprise," but the two must act in combination if the best results are to be attained. It is considered that the principal question which arises in connection with the subject of industrial organisation is the future relationship between employers and employed. The Committee quotes Mr. Neville Chamberlain's outline of the wants of Capital and Labour as follows:—

THE WANTS OF CAPITAL.

1. That labour should put forth its utmost effort in production.
2. That there should be reasonable notice of any change in wages.
3. That labour should not be unnecessarily withdrawn.

THE WANTS OF LABOUR.

1. A greater share in the distribution of the wealth it creates.
2. Greater regularity of employment.
3. Improved conditions of life in the factory and the home.

To these desiderata the Committee add the following recommendations as a basis for negotiation between Capital and Labour:—

(*a*) As regards the remuneration of employés the principle of payment by results should as far as possible be adopted by employers and employed.

(*b*) The basis of rates of payment for labour should involve such a scale as will ensure for all willing and efficient workers a fair and reasonable standard of living.

(*c*) The Government should afford opportunities for considering the amendment of the Trade Disputes Acts and of any provisions of the Factory and Workshop Acts other than those relating to the health of the workers.

(*d*) Encouragement should be given, as far as possible, to profit-sharing and co-partnership agreements, or premium and bonus systems on lines which have proved beneficial to employers and employed in the past, subject to the special conditions of particular trades, and to the maintenance of the standard rates of wages.

The Committee views with hope the conferences that have taken place between employers and the trade unions, and urges that such should be encouraged.

In this same section the practical relation of science to industry is reviewed. It is believed that the various agencies that are now at work on this matter will have far-reaching results. Among other points mentioned is the necessity for making the scale of remuneration for trained scientific employés such as will encourage students to prepare themselves to take part in the industrial campaign of the future. Other subsidiary questions mentioned relate to the use of State factories for private industrial work after the war, encouragement of technical education after the statutory school age, the amendment of the Patents, &c., Acts, removing restrictions to the adoption of new processes, labour-saving appliances, and new inventions; the improvement of all kinds of transport, better Government commercial intelligence information respecting competition and new openings, further direct representation of manufacturers in the Dominions, a greater sympathy on the part of the Government in regard to the promotion and amendment of legislative measures affecting British industry (especially in relation to conditions of labour), and "a preference on the part of Government Departments and local authorities for goods produced within the British Empire when needed for the requirements of the State."

In Section 2 the Committee deals with commercial and industrial policy; Section 3 relates to the treatment of enemy shipping (the ton for ton policy of the London Chamber of Commerce, and the after-war proposals of the British Imperial Council of Commerce); and Section 4 discusses finance and insurance. Practically one-half of the publication consists of a collection of appendices, which include the Paris Economic Conference recommendations, extracts from the Government Committee report on a Trade Bank, and memoranda relating to a Ministry of Commerce, the Consular Service, Restraint of Enemy Trade, the Registration of Business Names Bill, Anglo-Italian trade, &c.

Russian Electrical Control.—According to the decision of the Council of Ministers, the *projet de loi* drawn up by the Ministry of Trade on the transmission of electricity, has been returned to it for the purpose of removing the difference between the Ministry of Trade and the Ministry of the Interior. The difference consists chiefly of the desire of the Ministry of the Interior to subject the control of electrotechnical installations to the general police, whilst the Minister of Trade, in his *projet de loi*, contemplates centralising the whole control of the transmission of electric current in the hands of his own officials. As a result of mutual consideration, the Minister of the Interior agrees that it is possible to revise the *projet de loi* prepared by him on the police control of electrical installations, and to accept almost without correction the *projet* of the Trade Department. On the question of authorising new electrical installations, the Ministries of the Interior and of Trade have introduced a clause in the agreement making the authorisation of the electrotechnical installations completely independent of the consent of the representatives of the Ministry of the Interior. In case of the disapprobation of the representatives of this Department in local or central Committees *re* the electrical business, such disagreement is to be decided by the Council of Ministers.

The Ratho Railway Smash.—Commenting on the accident at Ratho, the *Edinburgh Evening Dispatch* remarks that "the smashed train was lit by electricity and not gas, and, as a result, there was no danger from fire to the numerous passengers who were pinned down, and who could not be rescued for over an hour after the accident. Had the train been equipped with gas, there is little doubt that the smash, as was the case at Gretna and Hawes Junction, would have been turned into a fierce and terrible holocaust, that would have intensified the horrors and casualties of the disaster manifold. As it was, the injured were spared that awful fate."

IMPORT TRADE OF CEYLON.

THE following figures, showing the value of the imports of electrical and allied material into Ceylon during 1915, are extracted from the recently-issued official statistics. The values for the previous year are given for purposes of comparison, and notes added of any increases or decreases:—

	1914. Rupees.	1915. Rupees.	Inc. or dec. Rupees.
Manufactures of copper.—			
From United Kingdom ...	30,000	45,000	+ 15,000
,, India	29,000	20,000	− 9,000
,, Germany	22,000	—	− 22,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	82,000	67,000	− 15,000
Electrical materials.—			
From United Kingdom ...	160,000	118,000	− 42,000
,, Germany	5,000	—	− 5,000
,, Other countries ...	16,000	8,000	− 8,000
Total	181,000	126,000	− 55,000
Scientific instruments.—			
From United Kingdom ...	19,000	16,000	− 3,000
,, India	—	3,000	+ 3,000
Total	19,000	19,000	—
Lamps.—			
From United Kingdom ...	135,000	62,000	− 73,000
,, Germany	72,000	13,000	− 59,000
,, Other countries ...	26,000	32,000*	+ 6,000
Total	233,000	107,000	− 126,000
Machinery, foundry and workshop.—			
From United Kingdom ...	651,000	554,000	− 97,000
,, United States ...	12,000	5,000	− 7,000
,, Other countries ...	2,000	2,000	—
Total	665,000	561,000	− 104,000
Other machinery, dutiable, not including tea, textile, and oil-making.—			
From United Kingdom ...	41,000	13,000	− 28,000
,, Germany	2,000	—	− 2,000
,, Other countries ...	3,000	3,000	—
Total	46,000	16,000	− 30,000
Ditto, free.—			
From United Kingdom ...	696,000	625,000	− 71,000
,, Germany	96,000	8,000	− 88,000
,, United States ...	50,000	14,000	− 36,000
,, Other countries ...	30,000	183,000	+ 153,000
Total	872,000	830,000	− 42,000
Telephone materials.—			
From United Kingdom ...	6,000	11,000	+ 5,000
,, Germany	1,000	—	− 1,000
Total	7,000	11,000	+ 4,000

* Japan Rs. 11,000.

(N.B.—15 Rupees = £1.)

Sounding by Electricity.—Experiments have recently been made on the banks of the Ohio River with an electric sounding apparatus, the principle of which is to produce at the bottom of the water, by towing a metallic body, a noise which is observed with a telephone receiver on board a boat. The plummet consists of a hollow cast-iron case about 45 cm. long and 10 cm. in diameter, which weighs 18 kg.; it is suspended from an armoured cable, containing two insulated conductors, which are connected to a microphone fixed inside the plummet and to the receiving apparatus at the surface. Tests have been made at speeds from 3·2 km. to 9·6 km. per hour. When the boat passes over shallows of clay or sand, a characteristic hissing sound is heard, whilst friction on rocks or gravel gives rattling sounds. Generally the sounds produced are easily audible at the receiver, except when the bottom consists of a very fluid mud. The depth is determined by the length of cable run out, and the speed of the boat, which causes the cable to assume a slanting position; these factors being known, the depth can be read from tables. The advantage of the method is that continuous soundings can be taken in a sheltered position and without slackening the speed of the vessel.—*Le Génie Civil.*

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Published expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

329. "Method of controlling speed of internal-combustion engines by means of electrical ignition." E. H. CAMBRIDGE & G. S. MACGREGOR. January 8th.

331. "Adjustable resistances and inductances." F. DE CANNART D'HAMALE. January 8th.

362. "Electric heating devices." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). January 8th.

363. "Electric arc devices." P. K. DEVERS. January 8th. (U.S.A., March 26th, 1916.)

368. "Apparatus for electric lighting." SIR W. G. ARMSTRONG, WHITWORTH & CO. AND A. S. CHEETHAM. January 8th.

400. "Automatic or wireless steering control." W. G. DE F. GARLAND AND C. TUCKFIELD. January 9th.

414. "Electric starting devices for internal-combustion engines." V. A. TRIER. January 9th.

426. "Electric switches." H. GARDE. January 9th.

436. "Induction coils or transformers." M. A. CODD. January 9th.

438. "High-frequency alternators." J. BETHENOD & F. GIRARDEAU. January 9th. (France, August 10th, 1915.)

449. "Stators of electric generators." J. BETHENOD & E. GIRARDEAU. January 9th. (France, August 10th, 1915.)

452. "Mechanical circuit-breaker for electrically-heated water apparatus." D. WHITE. January 10th.

467. "Process of cleaning ignition plugs of internal-combustion engines." S. COOPER & M. J. VARLEY. January 10th.

468. "Sparking plugs for internal-combustion engines." C. HUESS, LTD., A. M. PATTON & R. F. SPILLER. January 10th.

481. "Electrically-heated wearing apparel, &c." J. W. JENKINS. January 10th.

488. "Telegraph and telephone apparatus." INTERNATIONAL ELECTRIC Co. & H. E. R. ROOSE. January 10th.

502. "Electric controllers." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). January 10th.

528. "Electric welding machines." T. E. MURRAY & H. R. WOODROW. January 10th. (U.S.A., March 8th, 1916.)

538. "Apparatus for electric welding." J. CRICHTON. January 11th.

555. "Telegraphic printers." E. E. KLEINSCHMIDT. January 11th.

560. "Electric lampholders." W. ENGELKE. January 11th.

564. "Pocket lamp or torch." C. WEST. January 11th.

565. "Controller for electric time signals." M. E. PUGH. January 11th

566. "Bearings for instruments." BRITISH THOMSON-HOUSTON Co. (General Electric Co., U.S.A.). January 11th.

577. "Electrical signalling or indicating apparatus for indicating at a distance numerical data." E. A. GRAHAM. January 11th.

578. "Electrical apparatus for transmitting and indicating orders, numerical data, &c." E. A. GRAHAM. January 11th.

579. "Mine-door operating apparatus." W. M. HUMMEL. January 11th.

584. "Clutch mechanism for electric cranes." W. S. HUBBARD. January 11th.

609. "Ignition plugs." W. A. CLARK, H. G. LONGFORD, W. W. LONGFORD & SPHINX MANUFACTURING Co. January 12th.

614. "Electric warehouse crane." W. SPENCER. January 12th.

619. "Ignition chamber of two-cylinder and multi-cylinder internal-combustion engines." J. G. SANDWALL. January 12th. (Sweden, February 10th, 1916.)

625. "Signalling device." WESTERN ELECTRIC Co. January 12th.

634. "Device for obtaining non-alternating currents of maximum tension by the aid of three-phase or polyphase electromotive forces of low tension with one single-induction coil." E. BALZARINI. January 12th.

640. "Overload circuit breakers." IGRANIC ELECTRIC Co. (Cutler-Hammer Manufacturing Co., U.S.A.). January 12th.

686. "Magnetic material." A. F. BERRY. January 13th.

691. "Casings for telephone receivers." H. W. DOVER. January 13th.

695. "Device for reversal of primary current and for periodic communication of secondary circuit, to improve working of induction coil." E. BALZARINI. January 13th.

PUBLISHED SPECIFICATIONS.

1915.

17,781. APPARATUS FOR RENDERING WATER RADIO ACTIVE. L. Pagliani. December 20th.

18,115. ALLOY FOR ARC WELDING. D. H. Wilson & S. M. Rodgers. December 29th. (June 16th, 1915.)

1916.

622. ELECTRIC CIGAR-LIGHTING OUTFIT. R. K. Hearn. January 14th, 1916. [102,749.]

892. PRODUCTION OF HARD COMPOSITION FROM FORMALDEHYDE AND PHENOLS WITH CARBOHYDRATES, ALBUMINOUS MATERIALS, AND TANNINS. K. Tarassoff. January 19th, 1916. [102,751.]

1,620. MEANS OF EQUALISING OR BALANCING ELECTRIC CURRENTS APPLICABLE TO ROTARY CONVERTERS. A. H. Railing & C. C. Garrard. February 3rd, 1916. (Addition to 11,905/13.) [102,757.]

2,405. ELECTRIC SWITCHES. C. W. Gray. August 15th, 1916. [102,766.]

2,582. DYNAMO-ELECTRIC MACHINES. R. V. Morse. February 21st, 1916. [102,768.]

4,342. ELECTRIC LIGHT REFLECTORS. M. J. Railing & C. H. Pitman. March 23rd, 1916. [102,772.]

4,959. ELECTRIC MEANS FOR PRODUCING MUSICAL NOTES. L. de Forest. April 24th, 1915. [100,358.]

6,962. INTER-COMMUNICATION TELEPHONE SYSTEM. J. W. Dungey & C. B. Kersting. May 16th, 1916. [102,786.]

7,040. RAILWAY VEHICLE CONTROLLING SYSTEMS. W. B. Murray. May 17th, 1916 [102,787.]

9,032. ELECTRIC RELAYS. W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. June 27th, 1916. [102,793.]

9,140. SWITCH-OPERATING MECHANISM FOR USE WITH TRANSFORMERS AND OTHER ELECTRIC STARTERS. W. Barraclough. June 29th, 1916. [102,794.]

13,445. RAILWAY SIGNALLING APPARATUS. N. D. Rabady & W. H. Dyson. January 4th, 1916. (Divided application on 142/16.) [102,806.]